

August 28, 1961

Orbital Vehicle  
Data System  
In Development

B-52G Launches  
Hound Dog

# Aviation Week

*and Space Technology*

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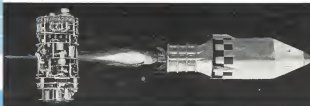


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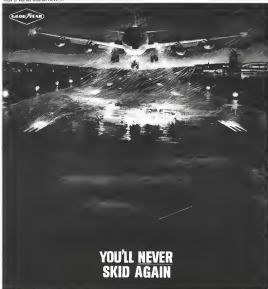
Heat Control Systems • Brake Brakes • Voltage Measuring Systems

## AVIATION CALENDAR

(Continued from page 7)

- Engineering and Management Center, Inc., 1121 West Avenue, New York, Sept. 14-15—Conference on Technological Communications, Institute of the Air Force, Defense Research Hotel, Philadelphia, Pa.
- Sept. 15-17—Annual Convention, National Assn. of State Aviation Officials, Miami Beach, Fla.
- Sept. 15-18—15th Annual Meeting, Standards Engineering Society, Hotel Sherman, Chicago, Ill.
- Sept. 20-21—Industrial Electronics Symposium, Institute of Radio Engineers, Sheraton Hotel, Boston, Mass.
- Sept. 22-24—National Convention of Aerospace Engineers, Air Force Assn., Philadelphia, Pa.
- Sept. 25-26—Annual Convention, National Aeronautics Assn., Mayo Hotel, Tulsa, Okla.
- Sept. 29-30—Symposium of Experimental Test Pilot, Fifth Annual Symposium and Aeronautical Research Society, Hilton Hotel, Beverly Hills, Calif.
- Oct. 2-4—Second National Communications Symposium, Institute of Radio Engineers, Hotel Utah, Utah, N. Y.
- Oct. 2-7—13th International Aeronautical Congress, Washington, D. C.
- Oct. 1-3—National Airport Conference, University of Oklahoma, Norman, Okla.
- Oct. 4-6—Asia Annual Convention, American Society of Photogrammetry, Johnson Hotel, New York, N. Y.
- Oct. 9-11—Mid-Year Conference, Airport Operations Council, Hilton Hotel, El Paso, Tex.
- Oct. 9-15—National Aerospace Engineering & Manufacturing Meeting, Society of Automotive Engineers, Ambassador Hotel, Los Angeles, Calif.
- Oct. 9-11—American Rocket Society's 15th Annual Meeting & Space Flight Report to the Nation, Columbia, New York, N. Y.
- Oct. 9-11—Aerospace Science & Photo Assn. Convention, St. Petersburg, Fla.
- Oct. 14-15—Tribute to Aeronautics, International 1950 Concept Conference, Hotel Grand Central, New York, N. Y.
- Oct. 15—General Aviation Safety Council, National Safety Council, Conrad Hotel, New York, N. Y.
- Oct. 15-16—Aircraft Meeting, Canadian Aeronautical Institute, Leaside, Ont., Canada.
- Oct. 15-16—East Coast Conference on Aerospace and Navigational Electronics, Institute of Radio Engineers, Lord Baltimore Hotel, Baltimore, Md.
- Oct. 21-23—17th Annual General Meeting, International Air Transport Assn., Sydney, Australia.
- Oct. 24-26—International Symposium on Aerospace Nuclear Propulsion, Institute of Radio Engineers, Rensselaer Hotel, Las Vegas, Nev.
- Oct. 24-26—Air Transport Assn's Engineering and Maintenance Operations Conference, Sheraton Hotel, Miami Beach, Fla.
- Oct. 26-27—Quarterly Regional Meeting, Assn. of Local Transport Services, Dallas, Texas, La. Tex. Hotel.
- Oct. 30-Nov. 1—General Meeting, Air Traffic Control Assn., Doublet Hotel, Miami Beach, Fla.

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\*Patent pending



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## the HEART

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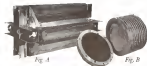


Fig. A

Fig. B

■—The area at **Leeson Moos Laboratories** are responsible for a good deal of the early research on fuel cells. Present work is in two main areas: the hydrogen-oxygen **Hydrex**® cell, and hydrocarbon-air **Carbox**® cell. Thus far, prototypes of such cells have demonstrated good performance. Outputs with hydrogen exceeding 150 watts per sq. ft. of electrode are readily achievable.

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■—A typical **Hydrex**® Fuel Cell test battery is shown here. Fig. A shows the complete assembly and Fig. B indicates the internal fuel cell electrodes. It is but one of many configurations designed by **Leeson Moos Laboratories**.

■—**Leeson Moos Laboratories** has been actively involved in the field of energy conversion for 13 years. This includes electrochemical, and nuclear power sources ranging from miniature reactions to gaseous batteries, have been investigated. Some of these are offered as products, for example, the **Dynose**® solid state battery, **Rosynk**® nuclear power pack, and **Bitadison**® nuclear heater. An informative brochure on current state of energy conversion techniques with emphasis on fuel cells is available from Department 4L.



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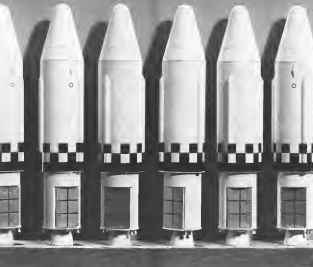
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## EDITORIAL

### Disarmament Agency Drive

Overwhelmed by the big Mack newspaper headlines on the Berlin crisis, a determined effort is under way on Capitol Hill to create a new agency of the government devoted solely to the problems of disarmament. This agency would be known as the U. S. Disarmament Agency for World Peace and Security, be operated as a 16-million annual budget and be staffed with about 150 people (AW Aug. 21, p. 19). The bill that would authorize its establishment states that this agency "must have the capacity to provide the essential scientific, economic, political, military, psychological and technical information upon which realistic disarmament policy must be based."

The disarmament agency would supply pertinent papers to U. S. negotiators and have a full-time technical staff competent to find the holes in Russian proposals. In short, the agency would do the homework for our negotiators and work full time at finding technical and diplomatic ways to break the disarmament deadlock. U. S. disarmament negotiators readily admitted during hearings on the proposed legislation that they often were not well enough prepared to take on the Russians at the conference table.

The effort to create this new agency reflects a general realization that all of the fiscal waters devoted to disarmament in recent years has been such ineffective because it lacked a solid, factual base concerning the technical facts of the problem outlined above. Before any real progress can be made toward a genuine and effective disarmament agreement, a solid foundation of facts must be laid to replace the nebulous fantasy that has sufficed in the past.

#### Need for Research

There has been strong, bipartisan political support for the new agency despite its mouth-filling title and its prodigious task. One aspect that has emerged from the congressional hearings on the subject is the lack of adequate research and development in the area of new and more efficient methods of detecting nuclear explosions. The lack of positive proof of the character of the very large underground explosions in the Soviet Union often supplies distortion of the need for better detection systems. The Soviets have claimed that these explosions were non-nuclear, earth moving operations, while since U. S. legislators have claimed that they were underground tests of small nuclear weapons (AW Aug. 14, p. 18).

Although it is obviously more prudent to assume the worst possible combination of these Soviet underground blasts, it is also obvious that we need devices that will positively identify their character. Dr. Herbert York, a nuclear expert who also was director of research and engineering for the Defense Department in the Eisenhower Administration, has said that the surface has barely been scratched in this field, and we hardly know

yet what the problems it poses really are. He also stated that development of effective nuclear blast detection devices is far more difficult than the development of nuclear weapons. We hope that regardless of the fate of the disarmament agency bill in the current Congress, action will be taken to expand both the scope and pace of nuclear detection research, because this area is the technical foundation on which any sound disarmament proposals must be based.

Congressmen report they are receiving a heavy flood of mail from their constituents opposing the disarmament agency because "now is not the time" and because of fear that it will weaken our international posture of determination in the face of the Berlin crisis. John J. McCloy, President Kennedy's disarmament adviser, points out that we probably will have to wait a very long time indeed if we wait for a period of international calm in which to launch the disarmament agency. We have been deluged in our taking the factual approach to the problems of disarmament years ago. To delay any longer, regardless of the international scene, will simply postpone the possibilities of moving toward effective action.

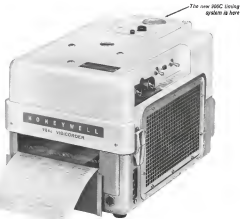
#### Soviet-Built Image

It may be difficult for U. S. citizens who have not traveled abroad extensively in recent years to realize how the Soviets have cleverly constructed a false image of a warren, rather than a solid United States built only on imposing its will on the world by naked force. It comes as a shock for U. S. citizens abroad to encounter the effects of this hidden campaign, but we have done precious little about countering it effectively. The establishment of the disarmament agency, with a corresponding technical effort to develop better search trace and detection devices, would be a big help in dispelling this false image of us created by the Soviets.

Even while the disarmament agency bill is moving through the legislative process, the Commerce and Treasury departments are making new studies of the impact of disarmament on U. S. industry. These studies will supplement the similar study conducted recently by Sen. Robert Humphrey (D-Minn.) and an another part of the Kennedy Administration's effort to reassess the rest of the world that we are generally anxious about developing a real solution to the problem of a nuclear arms race.

Nobody can predict now whether there ever will be an effective solution for the disarmament question. But if we fail to begin now to explore every possible means of achieving this solution and every possible technical support for it, we shall have failed miserably, not only in our duty to ourselves but also in the rest of the world that still looks to us for leadership and guidance.

—Robert Hots



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## WHO'S WHERE

### In the Front Office

Webster H. Wilson, board chairman of Hamilton Corp., Little Rock, N. Y., recording W. A. MacDonald, director. Mr. Wilson conducts air operations.

The Sir Hans Lord Byeman of Tarn, 40, painted chairman of the Air Skills Round Mounds, of Aviation, London, England, was making Air Marshal Sir Charles Grant, a pilot.

Robert H. Wood, former vice president and general manager of American Latic Products Corp., Hawthorne, Calif., a subsidiary of Davis Corp., and president of Hardman Tool and Engineering Co., Los Angeles, Calif., according to C. M. Cheate, who has resigned as president of both cos.

Capt. Henry A. Arnold (USN ret.) is assistant to the vice president and chief executive, United Aircraft Corp. East of the Rock, Conn.

James V. Duffy, Jr., president Smith-Holmstrom Corp., Elkhart, Ind., according to N. O. Smith—who continues to head the

Carol F. Milne, a director and chairman of the Institute's committee. Cheryl Aron, Industrial Inc., Eastington, E. Naval CAI cat. products. H. W. Hoffman, manufacturing. G. B. North, administration. W. R. Johnson, engineering. J. H. Thompson, sales. E. A. Wilford, finance.

Alaska Airlines, Inc. has named the following vice presidents: Chester L. Miller, operations; George R. Smith, maintenance and engineering; Kenneth J. Wadsworth, sales.

Edward Reynolds, Jr., President, The  
Mtn. Corp. Bedford, Mass.  
Brendley K. Smith, Executive Secretary of  
the National Science Council

Col. Allison A. Tinsley, staff captain, Strategic Air Command Office APO New York, is accompanying Rep. Gen. John R. McGuire, whose

### Chapters

George A. Hurns, study director, Electronic Division of Space Technology Laboratories, Inc., Los Angeles filed a subsidiary of Thompson Research Worldwide Inc. Other Electronic Division applicants: J. J. Schuman, manager; and C. E. Russell, assistant manager; Computer Di-

**Dr. Bruce Hoken**, head of Physics Ph.D. in Laboratory, Aero/Space Department, General Motors Defense Systems Division, Santa Barbara, Calif., and Arthur A. Vandehey, assistant.

General Electric Co.'s Flight Propulsion Division has appointed A. J. Bowers to its Washington, D. C. office to be responsible for Air Force and Navy propulsion engine programs including Foreign Military Air engine Programs.

(Continued on page 131)

## INDUSTRY OBSERVER

► Low-angle dogleg delivery (LADD) technique: now it replaces the earlier LARS delivery of nuclear weapons from low flying aircraft. Improved accuracy of the drop and automated accessibility of aircraft and more manoeuvring room for the change. Pilot makes the same low-angle run as in the target, pulls up only slightly at bomb release to peak altitude of several hundred feet, then halfrolls, pulls positive  $g$  to decrease altitude, halfrolls again in the descent and pulls out with positive  $g$  to continue at low level.

Extremely high-intensity beams from optical lasers may cause serious damage or even blindness to the human eye if the beam falls directly on eye tissue. USAF's Rome Air Development Center is sponsoring a study by New York University of biological effects of these beams, using animals as subjects.

►Captive flight tests of the USAF Douglas Shovel air-launched ballistic missile were begun late last month at Edwards AFB, Calif., shortly after tests of electromagnetic interference between the missile and the Boeing B-12 launching aircraft were completed. Air launch tests are continuing at Eglin AFB, Fla.

► Watch for Army to create its own hot pilot school to train pilots in evaluation of helicopters, assault transports and tactical fighters. Recent graduates of the all-Army course at the USAF experimental hot pilot school considered the course too specialized in high-performance aircraft. School had no helicopters or low speed assault for student firing.

► Plan to launch a Mercury communications package into orbit with a Blue Bird vehicle has been scrapped. Package returns failed to check out and the project dropped until the firm attempts to submit a complete Mercury episode about Mercury Atlas 4 in 2004.

► Many seamounts are expected to bid in National Science Foundation's competitive next month for the Project Mohole contract. Programs also supported by Navy and National Academy of Sciences, may reveal valuable oceanographic and geological data by sampling earth's crust at the ocean's bottom. Mass drilling effort will take place in the Atlantic off Puerto Rico. Contractor will cover drilling, exploration and sampling, as well as data gathering, reduction and analysis. National Science Foundation apparently tired of dealing with a number of small companies as it did earlier, wants a prime or team contractor.

►The USAF Lockheed C-141 jet cargo transport is expected off the us stretch late in August of 1964, with five more due that September. Operational deployment date is June, 1965. A contract for 12 aircraft is expected to be let by December of this year.

• First flight of a Bios space probe, which is a follow-on to the New program, will be made by National Aeronautics and Space Administration this fall from Pt. Arguello, Calif. An Argos D-8 will be used to send the package, containing six verble eggs, skin tissue and bread mold, through the Van Allen radiation belts.

• Investigations by USAF's Aeronautical Systems Division has indicated that one of the super high frequency range from 1 line to 14 line may solve the problem of transmitting radio signals through the ionized layer of the first ionosphere and/or spacecraft re-entering the atmosphere from ballistic and orbital flights.

► First sale of a Canadian Black Brant research rocket has been made to Air Force Systems Command's Air Proving Ground Center at Eglin AFB, Fla. Rocket is being developed by Canadian Avionics Research & Development Establishment and Fentel Aero-Industries, Inc. (AW July 17, p. 67).

► Rocket sled test track at Hvaccon Mesa, Utah, which is operated for Air Force by Colson Engineering Co., will be put on a steady basis in December. It has been used previously for tests of ejection seat systems.



# Space Patent Rules Facing Challenge

Industry witnesses reluctant to complain about NASA policies; Congress plans to survey 50 companies.

By George C. Wilson

Washington—Anecdotes of the multi-billion-dollar U.S. space program fuel the aerospace industry's increasingly worried about the National Aeronautics and Space Administration's patent policies—but the industry's worried about suing too.

This prevailing mood shows itself in the industry's latest attitude toward public hearings on patent policies and its strategies on inventions disclosed to NASA.

An Aerospace Week study indicated that only a fraction of the inventions made under NASA research contracts actually are reported to the space agency. The contractors apparently feel that, under NASA patent policies, competitors will exploit the inventions once they have been reported.

Aerospace firms, despite their anxiety over the NASA regulations, were reluctant to express their fears before the House Science and Astronautics Patents Subcommittee. Their reluctance, according to those directly involved, is based largely on the belief that such testimony might hurt their chances of getting future NASA contracts. The subcommittee now will try to get more indication of industry's views on NASA patent policies by sending questionnaires to about 50 aerospace companies.

As of the Aug. 21 deadline, few firms had asked formally to be heard at a public hearing on the proposed patent regulations which NASA has submitted to the Sept. 13. This does not mean, however, that the industry is back of the regulations. Some of the regulations would give the space agency a radically new role in the invention field. Instead, however, they believe the industry's lack of response stems more from reluctance to offend NASA, plus a feeling that Congress will change the patent rules anyway.

## NASA Patent Statistics

The 1988 year just past NASA tells its contractors what its invention policies are, and the contractors are developing contracts. However, the act does empower NASA to waive its title to an invention after the contract is signed. But industry spokesmen have complained that the waiver procedure is more trouble to contractors than it is worth. One apparent result of this feeling is for industry to conceal the inventions.

Figures compiled by NASA between November of the 1981 year and August 28 of this year show that:

- Of 268 inventions have been disclosed by NASA contractors. Of that total, 87 were disclosed by United Aircraft, 41 by other commercial contractors and 72 by such non-profit firms

as the California Institute of Technology's Jet Propulsion Laboratory. JPL alone accounted for 65 of the 72 inventions disclosed by non-profit firms.

- In contrast, 331 inventions were disclosed by NASA employees. Since NASA employs only about 175,000 of the total space research, this clearly indicates that the private firms who do the remaining 85% are not disclosing their inventions.

## Subcommittee Hearings

Chairman Emilio Q. Daddario (D-Calif.) of the House Science and Astronautics Patents Subcommittee first announced a long series of hearings of NASA patent policies. It is an open secret that the subcommittee has

## USAF Acts on New Policy

Washington—Air Force has taken steps to implement a new policy for managing the development and production of commercial and military systems which in the Defense Systems Division and the Air Force will ensure better management of research and development.

NASA contract operations under (COT) is the first step in a new policy to be developed under the new policy, which was first disclosed by Dr. Theodore V. Nelson, assistant USARF director for research and development, at the recent Military Electronics Conference (AW July 1, p. 25).

Research Corp. research was selected as prime contractor for detailed design, development, and test of the T-14 system. Military Corp. will provide USARF with general systems engineering assistance and Systems Development Corp.—another non-profit company—will undertake responsibility for design and program.

into research when it invited firms to bid. But those who did appear added to the criticism of the general NASA patent policy, and expressed alarm over the proposed patent regulations published in the Federal Register last July 15.

William H. Armstrong, vice president and director of research and development for General Electric Works, told the subcommittee that the patent policies in the NASA act "are so broad in their language and sweeping in their possible effect on our business that General Electric does not enter into any agreement with NASA or any of its agencies or subcontractors which might be construed to involve research and development work on our part."

"The risk of losing to the government all rights in inventions and technical data arising out of the performance of such a contract are too great for the company to assume."

Declaring that General spent \$9.5 million in 1980 on research and development, Armstrong contended that "the contractor should at least be permitted to retain and use these inventions and technical data which his skills have created."

In a similar vein, Ernest A. Goetz, technical manager to the president of American Bosch Air Corp., told the subcommittee the NASA patent policy has "a debilitating effect upon actual research and development effort in our traditional U.S. patent system." Many of the aerospace contractors and while questioning that the patent was threatened to slow down the U.S. space effort.

## Defense Policy Favored

The aerospace industry, in its Defense Department's policy, over NASA's Defense without employing NASA's employment waiver provisions, made plans for the contractor to be the exclusive holder of the invention. However, Defense retained the right to have the invention transferred for its own use without paying royalties on it.

But in the commercial field, the research contractor under the Defense Department has the exclusive right to exploit the invention. Backers of the Defense policy maintain it provides the needed incentive for creating and marketing new systems.

The proposed NASA patent regulations do not affect the agency's jurisdiction for awarding title to inventions made under research contracts. The rules pertain only to licensing of the inventions owned by NASA. Under the proposed rules, the inventing con-

tractor automatically would be licensed to maintain his invention when he had reported it. He would hold the license for eight years or for five years after the date the patent was issued, whichever came first. If he did not exploit the invention within that period, NASA alone a public hearing could license another contractor to produce the invention.

The inventing contractor under the rules would obtain a nonexclusive, nontransferable license. This would enable him to maintain the invention without paying royalties to NASA. But his license would not stop other contractors from competing with him in getting business of their own from NASA.

NASA, however, contends, however, that the inventing contractor enjoys two big advantages under this arrangement. First, he automatically gets a license in case of the invention is disclosed to NASA. Therefore, he can start exploiting the invention right away, while other contractors must wait for the patent to be issued—this usually takes two to three years. Besides this headstart, the inventing contractor would not have to pay NASA the royalties charged by competitors.

NASA's rationale for issuing licenses to non-other firms is that the inventor does not exploit his invention in the sense that it gets into public use. This second contractor would have sole right to the invention, since NASA would assume an exclusive license. This, according to NASA, however, would permit the inventor to get the maximum payoff.

The proposed regulations do not explain how the NASA would go in patenting its invention from advantage. This point will be discussed at the public hearings Sept. 20. As of the Aug. 21 deadline for getting on the hearing's witness list, NASA and its had received requests from only five firms. Alfa-Chemical Manufacturing Co., Electronic Industries Assn., National Assn. of Manufacturers, National Society Industrial Assn. and Protection Unions.

Grand D. O'Brien, NASA assistant general counsel for patent matters, told AVIATION WEEK he was "disappointed" that the response was not greater. O'Brien and contractors in the space agency do not appreciate that NASA's proposed rules "put the inventing contractor in a preferred position" when it comes to promoting the invention. None of those who have asked to appear intend to support NASA's proposed licensing system, O'Brien said. And the aerospace industry's "has not really grasped" the potential benefits of NASA's proposed rules. Despite the witness list deadline, NASA will not discuss the issue being heard at the public hearing.



MA-4 Prepared for Launch

McDonnell Douglas's MA-4, scheduled for launch last week from Cape Canaveral, Fla., is designed to provide a system and all the complete Mission system in a one-of-a-kind flight. The McDonnell Douglas was not being, about MA-1. The MA-4 will fly 50 to 60 miles above the earth and the space vehicle will be the only one and it was subsequently removed. Note one, however, before launch between the capsule and the Ground Dynamic Atmosphere.

Second C. Yonke, vice president and director of patents for the Space Research Corporation of Space Research Corp. (now owned) industry's opposition to NASA's proposed rules when he reported before the House patents subcommittee.

Yonke said that he was "anecdotally" and said: "First NASA takes ownership of the invention away from the contractor, thereby destroying the incentive that he retains a proprietary interest

exclusive license) any invention which would induce him to run the normal risks of exploitation. Then NASA fails to take anyone who who will be willing to pay a royalty for the 'invention' is actually running the normal risks of commercial exploitation (possibly to a non-aerospace business).

"Then, after depriving the public of the use of the invention all three years, NASA proposes to transfer the ownership (and any license to anyone

lent to consent to a third party for a patent. That left a potential future patent battle as obvious. It is difficult to understand a number of laws and regulations which has as its purpose being something of an overkill from the original contract with the contractor to do a third party arrangement, yet was not.

Other industry witnesses said the proposed regulations must and NASA use the patent law. William D. Robinson, patent attorney for The Morton Co., said "it is a compromise of the patent objectives of the Space Administration to enter the business of patents as played in atmospheric properties."

As the NASA's proposal to collect royalties from inventions is clear, Robinson said "the patent law is the nature of it. It happens to be a law that is administered by a specific agency rather than by the people generally concerned with collecting royalties." Robinson added that in order for NASA to protect the contractors it licensed, it would have to fight infringement, "basically," he said. "You and I would have to develop a law where NASA would be directing its energies into commercial channels rather than scientific ones."

Albert C. Hall, Miami vice president of engineering, said the patent law is not a problem. He said it is important to change the patent statute now as NASA goes into these larger programs in order to get patent effect from the unbroken main computer technology.

Several other witnesses told the subcommittee the statute concerns, rather than the industry points, stand to lose the most from not being able to exploit inventions.

#### NASA's Position

NASA's defense against upcoming attacks on its patent law is somewhat weakened by the fact that NASA itself might require from the patent Congress. The House last year passed a bill ordered by NASA that would have given NASA patent authority, but the Senate, which passed the bill, did not approve it. The Senate, where several committees were investigating government patent practices with the hope of coming up with one even all.

Earlier this year, NASA told Congress it did not intend to give full patent rights in the near term regarding patents. James E. Verble, NASA administrator, said that while the space agency did not wish to hinder other agency NASA legislation before Congress and thus limit the patent rules did not pass the public's right to patent. NASA attorneys told the House that the House to pass pat-

ent legislation in the House of Congress, comprising the House and the Senate.

Patent legislation pending in Congress may have a bill sponsored by Sen. Russell B. Long (D-La.) in the House, which would give NASA the right to sue for patent infringement. The bill would also give NASA the right to sue for patent infringement.

Sen. Long's bill would give NASA and other executive agencies "technical" and "scientific" information to make under research contracts. The bill also would establish a Federal Research Administration to support U.S. interests in such an action.

Sen. Long's bill is similar to that sponsored last year in the House of the Senate Judiciary Committee. The bill would establish a Federal Research Administration to support U.S. interests in such an action. The bill would also establish a Federal Research Administration to support U.S. interests in such an action.

## Explorer XII Sends Mass of Data

Washington—Explorer XII's eighth orbital satellite has transmitted data continuously since launch last Sunday. The data will be put in a preliminary data acquisition schedule Sept. 1 because the satellite is producing such information that is needed, National Aeronautics and Space Administration and its contractors.

Scientists are receiving a mass of data on radiation and on the outer fringes of the earth's magnetic field from the 53.5 satellite, which was launched into orbit by Explorer 11 on Aug. 16 (AVW Aug. 21 p. 37). Before its 25th day in space, the satellite was not confirmed until Aug. 17. The orbit carries the satellite through both Van Allen electron belts.

Refined orbital elements place altitude at 47,500 mi., perigee at 180 mi. and inclination at 51.1 deg. Anger and his colleagues are studying the data. But NASA says they are well within normal requirements. Variations of plus or minus 5,000 mi. from the 50,000 mi. altitude can be expected from the third-year reliability evaluation. NASA says the satellite is well within normal requirements.

The satellite was launched by a NASA Douglas Delta vehicle (see p. 17), marking the fifth consecutive successful satellite launch for NASA. NASA's first satellite was launched by the Apollo Research Center, Beltsville, Md., to obtain real time data, but the agency said it has not had an opportunity to stress its scientific conclusions. Detailed analysis of the satellite's magnetic field is several days from the primary magnet sta-

tion which any legislative provision for a patent policy.

The Rebo-Durillo bill would ensure NASA either to keep or relinquish title to inventions but would in any case allow a royalty-free license for the U.S. This would, in effect, give NASA whether authority under that embodied in Defense Department regulations. Rep. Durillo said Attorney General's bill to protect public law was "Revolutionary." He said his bill would give the NASA administrator the flexibility needed to assure invention to participate in the open program and to protect the public interest.

The Commerce Department and National Aeronautics and Space Council is in consultation with other scientific agencies are trying to work out an overall patent policy in time for consideration during the next session of Congress.

These studies plus NASA's Sept. 20 hearing on its proposed licensing rules are expected to lead to a patent contract modification of patent laws to meet space age requirements.

Johnston, South Africa, Western Australia, Santiago Chile.

Satellite has a one-ton electronic mass spectrometer which radiates effects are expected to degrade the output of electronic components by that time. Lifetime of the satellite in orbit will be determined by the extent of the solar radiation.

Dr. Frank B. McDonald, project scientist from NASA's Goddard Space Flight Center, said the satellite is expected to observe more than 100 Van Allen electron belts, solar wind and the outer portions of the magnetic field. Solar winds are believed to be the chief cause of propagating ionospheric effects with its magnetic field, he said.

Data are stored in a 512-word memory unit, which sorts the information and feeds it to the frequency-modulated telemetry. Data are being transmitted on 158.82 mc.

## U.S. Plans Workshop On Weather Satellites

Washington—Meteorological service representatives of more than 100 foreign nations, including those from the Communist bloc, have been invited to a 10-day workshop on satellite meteorology to begin here Nov. 11.

Workshop is sponsored by the Weather Bureau and the National Aeronautics and Space Administration to promote cooperation in satellite meteorology. Detailed analysis of the satellite's magnetic field is several days from the primary magnet sta-

## Ranger I Misses Planned Path; Systems Working in Low Orbit

Washington—Attempt to launch the Ranger 1 spacecraft into a deep space trajectory failed last week when the 577-lb. instrument package was rejected into a low earth orbit.

The spacecraft was launched at 6:08 a.m. EDT Aug. 21 from the Atlantic Missile Range, in the first use of an Atlas-Agena 1 launch vehicle by the National Aeronautics and Space Administration.

Separators of the instrument package from the Agena vehicle apparently occurred and the attitude control system appeared to be functioning. Also working well were spacecraft electronic computers, and the flight provided a check-out for these instruments. Satellite lifetime was estimated at about 14 days.

Ranger 1, a California Institute of Technology Jet Propulsion Laboratory project, was the prototype flight vehicle for rough lunar landings. Deceleration was 401,000 mc and range, 71,000 mi.

#### Single Burning Cycle

Reason for the low trajectory was not immediately determined, but there is a possibility that the Agena engine had a single burning cycle. The engine was programmed to ignite, shut down for a cooling period and reignite. NASA was studying the possibility that the Agena had not advanced during the normal burn period.

Agencies must regularly be demonstrated in Korea and Maine launches by adjusting the orbit of those satellites.

Ranger program presently consists of four main launches, the last three designed to impact on the moon. Deceleration is under way, which may lead to a maximum of four to six days in flight to obtain open observation for the Apollo moon lander landing program.

The 14-lb. Ranger spacecraft carried the following equipment:

- Solar collector: reflection only, developed by JPL.
- Six medium-angle particle detectors developed by the State University of Iowa and used by the University of Chicago.
- Cosmic ray ionization rate indicator, developed by JPL.
- Triple-channel camera ray indicator developed by the University of Chicago.
- Magnetic field analyzer which was developed by NASA's Goddard Space Flight Center.
- Solar up detector, developed by the

Aerospace Corporation's Los Alamos Scientific Laboratory and the Space Corp.

• Neutral hydrogen pressure detector, developed by the Naval Research Laboratory.

• Comet dust detector developed by Goddard.

#### Flight Sequence

Flight profile of the launch vehicle called for the 14-lb. vehicle to appear to coast for 30 sec. after burnout of the General Dynamics Corp. Atlas.

The second reason the Ranger payload was not to be attempted was the Agena's guidance control system was to have maintained the vehicle in an attitude horizontal to the earth. Thus the Agena's attitude control system, developed by the Bell Aerospace Co., was scheduled to fire for 168 sec., followed by a second coast of 780 sec. in the 108-mi. high parking orbit.

Attitude control was to have been effected by precessing the gyro 4 deg./min.

Second firing of the Bell Agena engine, for 65 sec., was to have kept payload there, taking the entire vehicle into a parking orbit and placing it on a triangular trajectory. At 170 sec. after first engine shutdown, the Ranger payload was to have been separated from the Agena, the latter being used 180 deg. by the mission system. The Agena was to be used by the firing of a retrorocket.

Ranger was first scheduled for launch on Aug. 15, with the cost of \$2.7 m., a post-launch delay by Cape Canaveral caused a postponement. Earlier in the year, a premature separation of the Agena had to be replaced.

#### Further Postponements

Launch was postponed again on three different dates July 11, at 17:30 sec., when the spacecraft failed to ignite retrorocket, Aug. 15, when the Agena failed to ignite retrorocket, and Aug. 15, when the Agena failed to ignite retrorocket. The Agena failed to ignite retrorocket, and Aug. 15, when the Agena failed to ignite retrorocket. The Agena failed to ignite retrorocket, and Aug. 15, when the Agena failed to ignite retrorocket.

The Agena failed to ignite retrorocket, and Aug. 15, when the Agena failed to ignite retrorocket. The Agena failed to ignite retrorocket, and Aug. 15, when the Agena failed to ignite retrorocket. The Agena failed to ignite retrorocket, and Aug. 15, when the Agena failed to ignite retrorocket.

Started 1 mile before launch, the con-

troller was to have fired 100 m.

• 1400 sec., to initiate the power being provided by the large of the two main motors, from 1.5 to 3 volts.

• 2100 sec., to turn on those scientific instruments which had been shut down during launch by the Van Allen electron belts.

• 2200 sec., to extend the attitude control package, located at the end of a mast boom, about 4 ft. from the main body of the spacecraft to extend the solar panels.

• 2300 sec., to activate the attitude control system, the sun sensors, roll and pitch and yaw. The system was to be used to maintain the vehicle in a stable attitude.

• 2400 sec., to activate the attitude control system, the sun sensors, roll and pitch and yaw. The system was to be used to maintain the vehicle in a stable attitude.

• 2500 sec., to change the attitude of the telescope, only the Ranger has been orbited from the webbing to avoid its operation.

• 2600 sec., to change the telescope's field of view, only the Ranger has been orbited from the webbing to avoid its operation.

• 2700 sec., to change the telescope's field of view, only the Ranger has been orbited from the webbing to avoid its operation.

• 2800 sec., to change the telescope's field of view, only the Ranger has been orbited from the webbing to avoid its operation.

• 2900 sec., to change the telescope's field of view, only the Ranger has been orbited from the webbing to avoid its operation.

• 3000 sec., to change the telescope's field of view, only the Ranger has been orbited from the webbing to avoid its operation.

## Venus Probe Finds Solar Winds Slight

Smart Venus probe launched Feb. 12 found only slight solar particle density outside of solar clouds, according to Dr. R. B. Mariani of the Astronomical Council of the Soviet Union.

He observed that the surface of Venus has its largest magnetic field during solar storms, and if there is a steady solar wind it is extremely slight. The Ranger 1 spacecraft launched last week, and Aug. 2, when a spacecraft in the Venus probe, but the instrument package did not go into its planned trajectory (see p. 25).

Dr. Mariani said detectors on the Venus probe observed a single charged particle in a solar coronal region of space. Measurements were made with a series of ion traps capable of detecting protons that have temperatures above 1,000°.



# British Unveil Two New Light Plane Entries

London—Two new British business planes—a light twin and its single-engine version—are being designed by Baele for small flights early next season.

The plane for the Baele Miles 218, a four-seat executive and the Baele Miles 117, two-seat version of the 218. They will be 50th and 50th planes in the Baele family, based by the Baele 218, a twin-engine, will be unveiled later at the annual Farnborough show of the Society of British Aircraft Constructors (JAW Aug. 7, p. 28 Aug. 21, p. 15).

Design team, headed by George Miles, technical director of the Baele group and chief engineer of Baele-Miles, regards the 218 twin as a Gemini replacement. Price details have not yet been fixed but the twin will sell for about \$14,000 and the 117 for about \$5,000.

The airplane will have two doors, dual controls, and a portable radio. Powerplants will be two Rolls-Royce Continental C-300A of 100 hp, each, driving Dowty-Rotol Inc. Rotolax variable pitch metal propellers. Dimensions are span, 37 ft.; length, 25 ft. 3 in.; height 7 ft. 5 in. Gross weight is 2,750 lb.

Miles said design cruise speed is 130 mph with a full-load range of 645 mi. From empty a 1,000 mi.

## Three-Seat Composite

The Baele Miles 117 single-engine version can be converted into a three-seater. Also, it can be made into a four-seater, with a 117 ft. 5 in. for the three-seater version. Normal cruise, using the C-300A powerplant offered, is 115 mph. Range with capacity payload is 570 mi. Dimensions are span, 37 ft.; length, 26 ft. 1 in.; height 7 ft. 5 in. Gross weight is 2,750 lb.

Spotlight controls will be on the new Baele 218 executive twin, used at the model meet with a United Kingdom price of something under \$6,000 (plus) or \$54,000. Powerplants are two half-horsepower Rolls-Royce Continental 10-475D engines producing 760 hp each and drive. Derry-Rotol McCulloch fuel-injection pump.

Aircraft includes as standard equipment a complete toilet and wash-up facility. Design passenger seat up 15 minutes ago after a conflict over the Peter Macdonald, Baele managing director, managed off-camera flight up to 1,000 ft. in a 5 ft. journey time.

The 218 is a wide range of cabin configurations. In addition to the four-seat version, the twin will be offered in five and seven-seat layouts. A five-seat composite, a three-seat pilot and navigation instrument, three-seat cabin



**LEFT: Two-engine executive plane** produced by British Baele group, the Baele 206, shown in this aerial composite in the foreground (foreground). Single-engine version of Baele Miles 218, twin powered by 100hp. Rolls-Royce Continental (below).



pilot cabin and a two-seat, two-seater executive plane.

The composite was built in one month.

Consultant on aerodynamics was Prof. A. D. Young, of Queen Mary College, London University. Britain was designed by Prof. Miles. The 100 gross weight is 6,110 lb. Dimensions are span, 35 ft.; length, 32 ft. 7 in.; height 12 ft. 3 in. Wing has a chord of 5 ft. Gross maximum payload is about 1,600 lb.

Baele twin the payload can be loaded 1,150 lb. at an operational cruise of 228 mph. Maximum cruise speed is 242 mph and maximum range is 1,718 mi. Airplane is designed to clear a 50 ft.

obstacle in 635 yards (new model) and duals out at 1,540 ft.

The airplane, along with others of the family, will be marketed world-wide by a sales organization being set up by Baele at its headquarters at Skewton, Surrey, Surrey. Baele, which stands for British Executive & General Aviation, consists of four companies: Baele Ltd., a subsidiary of Private Steel Co. Ltd., Baele-Aircraft America, Baele Miles Aircraft, and Baele Aviation France, Ltd. An Air Service Division is maintained at Redbridge Airport, Oxford. The French organization will handle both purchase and lease deals.

Other Baele airplanes all of which will be designed at Farnborough are:

• **AB09 Abolite** (1W Mar. 15, p. 17), which has been reported with a Rolls-Royce Continental C-300 engine of 175 hp replacing the 100hp Continental C-300A offered on the standard engine. This allows Baele pilot of using Baele Continental. The Abolite will cost \$11,300 in a four-seat configuration. Gross weight is 2,750 lb.

• **Baele AOP 218**, a follow-on to the Auster Mk. 5, designed as a private venture in collaboration with the British Army. It is powered by a 300hp. Rolls-Royce Continental which has boosted thrust power up to 50% to give the engine 140,000 rpm. New gross weight is 2,550 lb. with maximum payload of 2,4 ft. "Tallied" distance is about 100 yards and Baele says the plane can land in less than 70 yards. Maximum cruise speed is 145 mph and stall rate of climb is 1,610 ft./min. Baele, which hopes to fly the plane in 1967, also expects new aircraft, the AB 21, can climb a 1,610 ft./min. in 141 yards low at altitude of 7,000 ft. elevation and 100 temperature conditions. Dimensions at Span, 35 ft. 4 in.; length, 25 ft. 3 in.; height 8 ft. 11 in.

• **Mk 2000**, three-place, sport and touring plane that is a development of the earlier Auster Mk. 5, with sales worldwide. It has been tested in a glider tug and Baele says it will cost a 500,000 lb. price, holding two persons to a height of 2,000 ft. in about 40 sec. Powerplant is a 100 hp. Continental C-300A of 100 hp. Dimensions are span, 35 ft. 4 in.; length, 25 ft. 3 in.; height, 8 ft. 11 in.

## Delta Puts Five Satellites Into Orbit In Year To Set Reliability Record

Washington—Highly successful Delta launch vehicle has demonstrated the reliability of its 31 ft. 3 in. space vehicle by setting first consecutive satellites into orbit within 365 days. Its only failure was its first launch attempt.

Lafayette County for the National Aeronautics and Space Administration (NASA) Delta was to launch the Explorer XII on June 10, 1966, but the launch was delayed until June 17, 1966, due to a problem with the Explorer XII. The Explorer XII was launched on June 17, 1966, and the Explorer XIII was launched on June 18, 1966.

Combination of these successes and expanded NASA weather and climate programs progress have set increased Delta's role in space plans (JAW June 26, p. 12). If the requirement were, the Douglas launch team can fire one Delta a month from each of two pads at the Atlantic Missile Range.

Although the original program called for 12 Delta launches, each representing an in progress to provide 24 vehicles with more interplanetary, Delta launches have been increased to 18 Delta, including two by the American Telephone & Telegraph Co. as a test of commercial satellite.

Undersea has been delivered to AMR for the next four Delta launches, both scheduled this year. They use the S-18 orbital stage and observation and the fourth T-18 designated T-2. Since Delta launches are scheduled for 1967, they are in a long-term contract with AMR. The S-18 orbital stage—R, F and S, two interplanetary S-18 and S-17, and the S-18 orbital stage.

The S-18 atmospheric vehicle and a T-18 test have been scheduled for 1967.

Delta's 1,610 ft./min. Baele, which hopes to fly the plane in 1967, also expects new aircraft, the AB 21, can climb a 1,610 ft./min. in 141 yards low at altitude of 7,000 ft. elevation and 100 temperature conditions. Dimensions at Span, 35 ft. 4 in.; length, 25 ft. 3 in.; height 8 ft. 11 in.

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1965. No schedule has been set for the APTAT vehicles.

Vernon L. Johnson Delta program manager of NASA, headquarters, William R. Schneider, Golden State Flight Center's Delta vehicle manager and program manager has been people and is stimulated, with direct communication to Douglas AMR, and the Air Force Systems Command's Space Systems Division, which provides the first stage. Organization was set as a single manager in NASA's headquarters in person in the Golden State office and 10 at Cape Canaveral.

The Delta program has a single project contractor in the Douglas Aircraft Co., which is responsible for construction, development and launching. Government furnished equipment includes the Thor—which Douglas built—and the third stage Thor's Altair. Douglas's Labor Union is 345 workers. Douglas heads or subcontracts the remainder of the Delta system and assembly personnel and stages.

First Delta launch on May 11, 1966 from the Cape Canaveral launch pad to the atmosphere during the first phase recovery being required and taken of the third stage to space. As a result, the second Delta launch slipped in weeks and the program has been delayed to the end of the year.

Philosophy of upgrading system components requires a set part of the Delta program. They are in a long-term contract with AMR. The S-18 orbital stage—R, F and S, two interplanetary S-18 and S-17, and the S-18 orbital stage.

The S-18 atmospheric vehicle and a T-18 test have been scheduled for 1967.

Schneider told reporters. With the Thor, his plan is to use the Thor, and we didn't make it as a result. We can't add or take away reliability of Thor or of the second and third stages. The Thor and the second stage are the most reliable. The Thor Vanguard upper stage. Most systems escape to Delta as a result of Thor and second stage and control.

This has been used in about 13 of the 25 successful S-18 launches and probes. Boosters in the Delta system are standard Thor rockets which are used from the Thor assembly line and modified to support the Delta system. The Thor rockets have been designed for Delta launches, a 32 ft. 3 in. should be "short" periods and a 44 ft. 3 in. should be larger and larger.

NASA's Mission Analysis. That pads at AMR for Delta launches and does the pads with USAF. Thor was originally designed by USAF's Ballistic Missile Division, an intercontinental range, but the program was a special service with the Royal Air Force in England.

The additional Delta vehicle order will bring the cost per launch to about \$7.5 million, down from \$10 million. The cost of \$10,000 from the first order. Cost of \$10,000 from the first order. Cost of \$10,000 from the first order.

Construction of the 92 ft. 111-160 ft. Delta are:

• **First stage Douglas Thor**, powered by Rocketdyne S-1B liquid oxygen/liquid hydrogen engine with a thrust of 150,000 lb. Gross weight is 147,000 lb. and length is 147 ft. 3 in. The first stage is a Ball Thor's Labor Union. The Thor's second stage is a Thor's second stage. The Thor's second stage is a Thor's second stage.

• **Second stage Altair**, General Atomics, which is a Thor's second stage. The Thor's second stage is a Thor's second stage. The Thor's second stage is a Thor's second stage.

• **Third stage AMR S-18**, a Thor's second stage. The Thor's second stage is a Thor's second stage. The Thor's second stage is a Thor's second stage.

Second stage system and separation occur immediately after first stage launch.

Douglas Thor which conducts the Delta launch at AMR is headed by W. H. Hooper, chief project engineer of Thor system. Don G. Carey, Delta project engineer, and Glen F. Flannery, AMR system manager.





## a story of WESTERN Growth

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WESTERN GEAR CORPORATION

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## Navy Wants Ling-Temco-Vought To Build New Anti-Radar Missile

Washington—Navy's Bureau of Weapons has recommended the selection of Ling-Temco-Vought to produce the ANM-100, an anti-radar missile, a scheduled version of the Cassin missile which was canceled in July, 1968. Final Navy decision is expected by Sept. 1.

In an accelerated program made possible because most of the development work already has been done, requests for proposals which were invited early in July resulted in replies from 40 companies. The field was quickly narrowed to 15.

Ling-Temco-Vought, the professor of Ling-Temco-Vought, had progressed so far in producing development models of Cassin as in 1966 when the Navy. Much of what was learned in production, test support, production line design and target detection can be applied to ANM.

One of ANM will be about that of the supercavitator (the surface missile). It will be capable of being launched from Sparrow rails and possibly will use the same solid propellant motor.

Range of the missile will be a function of altitude. The higher the launch altitude, the further the range. For "on-the-rack" systems the range would be up to five miles. A 100-mile launch altitude could increase the range to 50,000 ft. The range would be extended to 25 mi. Higher altitudes would produce less small increments in range because of a steepening coasting trajectory.

ANM will be carried on all aircraft that carry the Sparrow III and will have the capability of being launched progressively. The top speed will be Mach 10 at least.

For launching and order systems, a command control system is needed with a delay firing mode to be employed.

Cancellation of the Cassin version during a severe budget squeeze imposed by the Eisenhower Administration. Although 150 million had been expended on Cassin, when the program was canceled, the Navy had only 125 mi. with a growth factor to 160 mi. the program was canceled to cost \$410 million and on the basis.

Cassin had progressed to the point where launch was made over the Pacific Missile Range in operations conducted from the Naval Missile Center at Pt. Mugu, Calif. It was proved by a preproduction liquid propellant. The program had not entered the production phase.

Much of the development work on Cassin was done by the Naval Ordnance Test Station at China Lake, Calif. After the Cassin cancellation, NOTS began studies on a new Cassin, which led to ANM. Most of the development work on ANM has been completed.

The ANM program is expected to last until the middle of 1969. It will involve a design development program to adapt the NOTS-developed vehicle to production and better its performance.

Ling-Temco-Vought, having already designed a prototype production line for Cassin, will follow along the same path in designing the ANM. Then it will construct the line. While this phase is under way, several independently produced engineering vehicles will be built, to be followed by an appreciable number of development models, also made by prototype production methods. Full-scale production will follow.

The contract will also cover Navy in providing logistic support, further development of NOTS of the vehicle and developing operational data requirements.

Associated as subcontractors with Ling-Temco-Vought in the Cassin project were the Reaction Motors Division at Thiokol Inc., Ogden, W. L. Moore and Term Instruments for guidance computers, Williams Co. for ship ping computers, Fluidic Motion Systems for the launchers, Raytheon Research Laboratories for target detection, Bell & Howell and Development Laboratories for control system and seeing components and Telen Engineering Co. for the recovery system.

## News Digest

**USAF-Looked: C-130E** Long range transport aircraft made an East flight test over at Dobbins AFB, Marietta, Ga. As a gross weight of 155,000 lb. the aircraft was carrying 17 tons of cargo from the East Coast to Guam, and one stop to the western Pacific from the West Coast. The loaded-up loading gear permits operation from soft airfield fields. It will become operational in March, 1969.

**National Airlines' negligence** from the Airline National Air Port was lost a change in the existing method of making strike payments. An original lawsuit of the new National Airlines for a good \$400,000 to Eastern for losses. Eastern reduced during a 16-day strike last year, but was able to collect only

\$75,000 from Eastern to offset losses from a 10-day strike against National. The rest of the lawsuit was to be paid by the court over competing airline arguments.

**Continental Air Lines** lost work related to the Civil Aeronautics Board for an extension of its route beyond Chicago to Cleveland and New York, with additional routes between Cleveland and Philadelphia and between Philadelphia and Detroit. Continental and the new service is acquired by the competitive program of the Civil Aeronautics Board. The new route is between Capital Airlines and United Air Lines.

**Geophysical Corp. of America** will perform a detailed study of the nature of nuclear debris following high-altitude explosions, under a \$52,500 contract awarded by the Defense Department. Research results of the debris to be expected in the event of a nuclear war probably be incorporated in the Vols Field program, after nuclear explosion detection system (AWF July 17, p. 21).

**Martin Co's Baltimore** division has been awarded an \$18,000, \$52,000 contract by the National Aeronautics and Space Administration to study the effects of the space environment on astronomical materials.

**Chicago Midway Airport** led the U. S. in total aircraft movements in April 1968 with 715,487. Federal Aviation Agency reported last week. Next in order were Washington National, Denver, Los Angeles and Tamm Airport. Midway, Mo. Midway also ranked first in air traffic operations with 14,316 aircraft movements followed by New York International, Washington National, Los Angeles and Chicago O'Hare. Washington National, topped the nation in revenue and passenger flights handled. Midway was led in the most cargo planes during April 1968.

**Federal Aviation Agency** reported last week that the number of passenger loadings U. S. trunk and local service airline aircraft in the 48 contiguous states increased from 49,915,976 in 1959 to 58,544,777 in 1968. Use of jets was responsible for the total number of flights dropping from 1,430,648 in 1959 to 1,141,069 last year. An estimated operations, passengers flying U. S. aircraft at annual points of 1,542,395 in 1968, compared to the 2,512,580 recorded in 1959.

**Civil Aeronautics Board** last week awarded Pan American World Airways a new route from Fresno and Mexico City to Mexico City, Mex. The order specified that all flights must stop at Mexico.

# AIR TRANSPORT

## Southern Strike Stir Pilot Discontent

**ALPA members move to force decision by challenging their president; weigh censure, term reduction.**

By David R. Hoffman

Washington—More than 4,000 Air Line Pilots Assn. members, dissatisfied with recent efforts to end the 15-mo-old Southern Airways strike, moved last week to force a special meeting of ALPA's 100-man board of directors to debate "radical and dramatic" action against the carrier.

Among the petting-pilot pilots are many who feel that ALPA President Clarence N. Sykes has neglected the "Southern situation" and, at the same time, paid too little attention to opinions voiced by the union's executive committee, major executive councils and rank and file membership on other key issues.

For this reason it is probable that should the directors be persuaded into special sessions, they will be asked to consider resolutions aimed at ousting Sykes—scheduled for his next trip to the Soviet Union (AW July 17, p. 12). Although Sykes was arrived as president of the International Federation of Air Line Pilots Associations (IFALPA) pilots elected by the ATL-CRO caucus last month oppose Alpa's "free" trade union leaders visiting Moscow.

### Re-election Issue

A drive to limit the ALPA president's term of office to two instead of four years also is being planned by some government members in the association. It would be a constitutional amendment passed at special sessions, Sykes might be forced to stand for re-election next year other than in 1964. In this regard, almost certainly, he would be opposed by a sizable majority of ALPA's executive committee.

A resolution passed unanimously by Trade Union Action Council U in Kansas City, Mo., a representative of the most recent outbreak of discontent within ALPA. Among that group was in Sykes' "contributions to the false propaganda by which the directors of the Soviet Union Control Court and unrepentant persons that free liberty and real unions are allowed to exist under communist rule," the resolution requests the union's regional vice president to investigate, also. Sykes went to Russia, whether State Department approval for his trip was sought and obtained, and whether ALPA's executive committee approves "such activity by the president."

The opposed vice president also was asked to obtain an investigation of ALPA's link with IFALPA. Such an investigation could result in ALPA's severing all ties with the international

group (unless and until the representatives of the so-called Soviet civil pilots organizations are barred from participating there), whether as members of IFALPA or as observers at its meetings or conferences.

Pilots representing more than 10% of ALPA's roughly 15,700 active members were expected to vote petitions by late last week, urging a nationwide ballot on whether to remove the board of directors in special sessions. But under ALPA's constitution, some 75% of the union's membership must vote for a special convention before one can be called.

During ALPA's efforts and last week that the executive board met Sykes' Russian visit had attracted the interest of the State Department. According to one veteran captain, State would not have approved his trip. TWA's president, Randolph B. Hearsh, is the Vice of America as to disavowance of the political attitude and degree of free-

dom granted by U.S. trade unions. Although by the Soviet administration due to being the privileged Southern Airways strike to a union approval of co-operations so far have been unsuccessful. A temporary federal regulation barred pilots employed by other airlines from sympathy strikes in the 61 other airlines by Southern. However, this regulation still may be challenged if ALPA's legal department elects to do so.

Federal Aviation Agency Administrator Hugh E. Hobby has refused to assist the union's operating authority after considering about 150 alleged firing safety violations. And against strike-breaking Southern pilots by ALPA (AW July 17, p. 49). And Accidents Board has refused to withhold federal liability from the airline despite ALPA's charge that Southern was guilty of unfair labor practices in settling pilot offers to arbitrate pilots' suit in court.

Finally, both Congress and the Department of Labor have refused to investigate the deadlock at Southern, which took 140 days after 137 pilots joined by ALPA struck the airline last summer (AW Aug. 1, 1960, p. 18).

Even though this group may accuse ALPA strike benefits ranging from \$410 to \$710 per month, officials of the so-called pilots in not the besting point. A July 17 letter forwarded to all ALPA members by Southern General J. W. McPherson, Jr., reflects this situation.

Claiming that their response with Southern's management "works much more efficient than received in the past," the letter noted suggested that dramatic action that executive "over the public" may be required in order to get results.

The letter urged all active ALPA members to encourage their members to "prepare to shut down all airline service throughout the U.S. if it refuses to achieve victory." It demanded the Southern situation a "union that will eventually destroy ALPA's bargaining power with the largest airline in the world."

An Airline Union strike check of pilots holding elected positions within ALPA disclosed almost unanimous opposition to a nationwide strike. And their pilots' refusal that ALPA should abandon the Southern situation a still higher priority, and that there should be no re-election in union efforts to force executive and legislative action on the strike.

### Intervention Requested

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**Los Angeles Airways' S-61L Scheduled for September Delivery**

Los Angeles Airways' No. 1 Sikorsky S-61L two-blade helicopter, seen for the first time in the helicopter carrier's markings, will be delivered in mid-September. Most of the helicopter is expected to be weight saving, but a rotor stop follows the main rotor and is located in a smaller and stops with conventional outflow. Pilot take-off from the rotor hub is expected but two shorter pilot take-offs will be possible previously, at the same location. Down from which the pilot controls is a more the rotor hub installation by Fokker Airline Agency test personnel. Final completion of the aircraft is expected in September. Before the hull put off of the cockpit is noted by the redesign of the forward fuselage compartment included in the Los Angeles Airways' configuration. Compartment size has been increased to 61 cu ft from the 45-cu ft, versus originally specified by the airline.

## Berlin Stymies U.S.-Soviet Route Pact

Washington—Scaling of the East-West trade pact between the U.S. and the Soviet Union for the first time in the U.S. to sign a bilateral air transport pact with the Soviet Union for commercial air service between New York and Moscow.

This refusal, which came after two weeks of negotiations between the U.S. and Russian delegations at a monthly French atmosphere, was blamed on the U.S. State Department on the "international situation, for which the United States is not responsible," but a State Department official said the battle between air clerks represents the two countries' refusal to sign.

Added with the talks had been a kernel to combine when a policy had not been agreed upon the agreement, the official explained that agreement is possible had been reached on Aug. 7, and that State at that time had been willing to enter formally into agreement with the Russians, once a few technical details were ironed out.

On Aug. 13, the battle between West and East Berlin was joined by East Germans. On Aug. 10, the U.S. decided the war "not an appropriate time" to conclude a pact.

Instead, the agreement had been

initiated by U.S. Ambassador, deputy undersecretary of State, and Gen. V. H. Logans, Soviet chief of the main administration of the civil air fleet. Purpose of initiating was to "remove the confusions scattered between the two delegations," according to State.

However, James M. Lindsay, special assistant to President Kennedy and head of the U.S. delegation, said it is highly probable that because of the U.S. decision not to sign, new talks may have to be held and the agreement negotiated in its entirety before service on the route can be started.

For American World Airways, U.S. flag carrier designated to operate the route, and Aeroflot formally agreed an agreement that the formation of scheduled, biweekly jetliners, construction of passenger airlines, and other technical matters.

The Russian Embassy here told Aviation Week that the Soviet government is ready to sign the agreement any time the U.S. is. The Russians have been extremely anxious to begin the service as a part of their long-term expansion program. Plans eventually will set an extension of the Soviet's proposed Atlantic route into Cuba and South

America, although these aspects were not noted in the talks here.

In addition to the U.S. refusal to enter into agreement on the route, New York, Moscow talks, one other details noted in the war of Russia granting an access to the Western hemisphere—access by the Scandinavian to prohibit Soviet commercial aircraft from visiting Scandinavian territory.

The route was initially proposed as a gesture toward ending the "cold war" and plans to develop a civil bilateral air transport agreement were included in informal exchange agreements of 1955 and 1959.

The decision to open negotiations on the route was reached in 1959 during talks here between Soviet Premier Nikita Khrushchev and former President Eisenhower.

When the Soviet Union broke up the Summer Conference in May, 1960, over the U2 incident and then shot down a USAF RB-47 reconnaissance aircraft over the Barents Sea, the U.S. cancelled the proposed negotiations. When the captured crew of the RB-47 was released last February, the U.S. proposed suspension of the talks. The Soviets agreed in June and negotiations began last July 15.

### Newark Jet Bam Lifted

Part of New York Authority has granted permission to American Airlines and United Air Lines to operate turbojet equipment into and out of Newark. A report issued in recent situation.

Newark previously has been closed to all jet action to turbojet aircraft. Gov. Robert B. Meyner of New Jersey earlier had opposed the turbojet operation from the field (AW Aug. 11, p. 48).

Aircraft being operated by the airline must not operate more than 112 passengers plus crew and any jet not off of calculations there a higher count level will be needed.

Initially, American will operate an Boeing 720B flight each day and United will operate three Caravelle flights daily.





PASSENGERS BOARD FRONTIER Convair 440 at Jackson, Wyo. Airline operates over 340's and exports to convert fleets to turbofans.

## Frontier Seeks Subsidy-Free Operation

By Robert H. Cook

Denver—Management of unequaled low fares and expansion of its present route system to more heavily populated cities in the Southwest form the basic strategy of Frontier Airlines' plans to become a subsidy-free operation.

Frontier is the largest of 13 local service airlines, with a route system of 4,690 air miles serving 63 cities in 14 states. The airline has continued, mixed (annual) revenue figures to new heights, but it feels that it cannot achieve its full growth and profit potential until it is removed from the Civil Aeronautics Board restrictions applied to subsidy allocations.

A staunch advocate of the Board's "use it or lose it" policy, President Lewis B. Moody, Jr., estimates that 12 of the airline's 63 cities fail to meet the CAB requirement that local airline service be provided only to communities which require it because of size, geographic isolation. While the airline's routes dropped service to several communities which previously produced less than 50 passengers a month, the remaining percentage of low points is high compared with other local service operations.

Throughout the past 10 years, points to such communities as Imperial, Neb. (pop. 1,500), which has been producing an average of only 11 passengers a month as a daily service schedule of two round trips. Other typical examples are Lewiston, Mont., with 14 passengers a month on two daily round trips and Laramie, W. D., which busied an average of less than 25 passengers over an 11-month period.

Primarily in the north-north center Frontier has a route system following the Rocky Mountains and stretching from the area of the Canadian border to southern Arizona and New Mexico. The average passenger load on the airline of 130 is one of the highest among the local in high altitude in the aircraft traffic producing potential of its route system in such areas. Wyoming, which has a total population of less than 400,000, Frontier serves nine routes in that state and totals an average of 520 per passenger.

The problem is even more acute in the North where Frontier is operating to end service to five cities in Montana, North Dakota and South Dakota, after experiencing unprofitable operations for these points for more than two years.

### Route Sale

Rather than undergo a lengthy CAB hearing, Frontier has asked the Board to approve the sale and transfer of route segments between these points to North Central Airlines as a practical extension of the North Central system, which also provides service to a north city, though the Tulsa route to Minneapolis St. Paul. Transfer of the routes, which did not fit into Frontier's predominantly north-south pattern, is expected to drop Frontier's annual deficit bill by \$11 million and would give it a route to its first one-way route service into the Twin Cities, Frontier contends.

Although in the matter to direct it sell off poor traffic points also have brought into focus the growing local

service airlines problem of state vs. federal authority.

This has been the case in Nebraska, where Frontier attempted to drop its September 13 service between Omaha, Wyo. and Omaha, Neb., in Cheyenne, Wyoming. Although Frontier's Colorado bus and Canada Expressway was granted by a CAB decision, but the airline has been forced to return the service under a court injunction obtained by the state last September.

During its appeal hearing before the full Board, it was estimated that since June the route, estimated for \$475,000 of Frontier's annual schedule bill of about \$6 million or \$3 in subsidy for each \$1 of revenue produced by the route. The state has estimated with a potential that direct service between Cheyenne and Lincoln be obtained at an estimated subsidy cost of \$145,000. A full Board decision is expected soon.

Frontier is not sure, however, that an affirmative decision from CAB would put an end to the dilemma. Frontier has deleted the route from its system since last year, but has continued the service without any subsidy payment for this segment. Should the Board state a formal cost and demand to drop the service, the state might act, further diluting airlines in the market. Frontier is optimistic that the Nebraska State, British Commonwealth, which has been fighting the service, would acquiesce, not accept the Board's final decision.

Cl. Rex Woods, executive vice president of Frontier, sees this problem as one of the major obstacles to the airline's growth. Pointing to the relatively

small population of most of Frontier's route cities he said that expansion into areas of high population growth potential is a must.

The dual role of operation of subsidy payment, under which Frontier has been operating since July, holds great promise for carrier management flexibility and expansion, Woods said, but the system must be based on industry overall performance before its full value can be assessed.

One problem with the new system which poses potential to a direct plane subsidy per station served, is that while overall intermediate stations may be dropped, leaving isolated, the actual mileage along the route may remain virtually the same with little change in operational cost to the carrier. The mathematical complexity, Woods feels, has encouraged many local service operators to refuse low traffic points rather than run the risk of failing to recognize full operational costs.

To avoid the airline's growth risk, local eventual freedom from subsidy, Frontier needs a series of new routes being, transferred from its Denver headquarters to Albuquerque, N.M., El Paso, Texas, Tucson and Phoenix, Ariz., Las Vegas, Nev., and Los Angeles, Calif., and wants a direct route between Salt Lake City, Utah and Phoenix.

Application of future points should applied for under the Southwestern Area Case and the Southern Rocky Mountain Case would give Frontier the access to lower population centers which it needs to develop a greater exploitation of its route situation and low dependence on item payments and economic with major airlines in these areas, Woods said.

### New Problems

While the subsidy-to-equipment program of the airline carries low overheads and the public, Woods also contends that this very program has created new problems for local low service operations. Already being each short had traffic to improve highway stations and profit and market local service airlines are experiencing new problems.

Frontier has attempted to accommodate passengers who want to make frequent non-stop flights. Rather than take a local flight which would require a close connection with such service, Woods said, some potential passengers now drive to the nearest major airport.

Frontier now operates 7 Conquest-440s and 15 Douglas DC-3s, including the Continental Divide 13 lines over 24 in. It expects to phase out most of its Douglas equipment, convert the 39s to turbofan power and purchase British Airways Corp. BAC-111s whenever it is able to acquire any are granted.

Frontier signed a letter of intent in July to purchase six BAC-111s for delivery



LEWIS B. MOODY, JR.

beginning in 1965, on the condition that a firm final order will be signed by the start of next year.

Operational flexibility and economy are the major reasons for the interest in the new program, it was noted, which Frontier feels would be ideal for operation from many points on its routes which are at altitudes ranging from 3,000 to 7,000 ft. Frontier made detailed analysis of cost comparison of the BAC-111's proposed operating figures and compared them with the Air Transport Association cost formula as applied to Frontier's actual route segments.

Cost projections for the British turbojet worked out to within one cent per plane mile difference, Woods said.

Meanwhile, the airline has concentrated on getting the maximum revenue from its present route system. Revised budget projections last year resulted in a 51-percent decline in Frontier's expenses while gross operating revenues reached \$117 million as compared with \$10.7 million in the previous year.

The airline's current plan to drop three of the 13 one round which ended in July of 1961 the airline's average annual load factor reached 86.7% as compared with 79.7% for the previous year. The airline's current plan to drop three of the 13 one round which ended in July of 1961 the airline's average annual load factor reached 86.7% as compared with 79.7% for the previous year.

Frontier has also stepped up its rate promotion to such service areas as the Grand Canyon, the Black Hills and the Grand Tetons, with promotional bus chartering, two services and points along with "tailor-made" rates. The airline has also stepped up its rate promotion to such service areas as the Grand Canyon, the Black Hills and the Grand Tetons, with promotional bus chartering, two services and points along with "tailor-made" rates.

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## 200 Workers Strike

### Bankrupt British Linc

London—Governess Airlines, KCL, Ltd., parent British independent turned into liquidation in British Petroleum and British Airways for management of debts, but much was negotiating with British United Airways for sale of its Gatwick airport, following a week stoppage of 200 mechanics there.

Managers disclosed over adverse publicity, the Independent Air Transport Association and its 13 member airlines were working with hotel groups for action program which had flown to European holiday spots via Overseas Airways. The airline's planes now are grounded.

The week stoppage centered when the Gatwick mechanics demanded further details on their financial future with the airline. A number of workers have already joined BUA.

As liquidation loomed, Overseas Airlines filed a suit against British Petroleum, claiming damages for an alleged breach of contract to supply aviation fuel. What has not yet been announced.

Overseas Airlines' fleet total about 52 million, of which about 370,000 each is owned to British and British Petroleum. The airline, formed in 1955 by British Airline, primarily does group charter work, and has applied for 11 scheduled routes to the continent in opposition to British European Airways.

As a means to repay the debt was initiated in British Petroleum, which said all fuel supplies to Overseas Airlines at Gatwick, Airport as a peak traffic time for the airport.

As well as Overseas had been paying about \$5,000 a day in fuel bill, but BP threatened that the payment was for indirect payment and did not apply to the fuel bill.

BP's move was quickly followed by British Airways, which declined to supply fuel to the airline. The airline's figure on the Overseas debt accepted to use it as "comparable" to BP's. Overseas owns BUA for major repairs and maintenance at the BUA Gatwick facility, and has done so to the airline's "own" figure on the Overseas debt accepted to use it as "comparable" to BP's.

The airline has a number of lease flights, the most important of which is to BUA, which provides the airline with a number of lease flights. The airline has a number of lease flights, the most important of which is to BUA, which provides the airline with a number of lease flights.

Overseas said its difficulties resulted from some "intermediate" spectrum capital investments in airlines (15 North Stars were bought from Trans Canada) and the difficulties of obtaining operations between Gatwick and "South-east."

# BULLETIN:

## AeroShell Oil W becomes first fully compounded additive oil to win approval of every major aircraft piston engine manufacturer in the U.S.

Aircraft, large and small, have logged millions of flight hours on Shell's new additive oil—the first fully compounded additive oil approved by every major U.S. manufacturer of aircraft piston engines.

Here are answers to 10 key questions about AeroShell® Oil W—how it helps keep engines cleaner, reduces wear—crucial extends periods between engine overhauls.

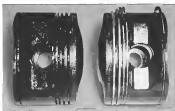
1. What types of aircraft can use AeroShell Oil W? Piston engine planes of any size. Helicopters, too.

2. Why is it called a non-ash dispersant oil? Because it contains special non-ash additives that help keep tiny, soot-like particles in the oil from clumping together and forming deposits. These particles cannot be removed and dispersed.

3. How does this oil affect engine performance? It means that engine parts stay cleaner. This lubrication pays off all the way they go. Your engine can run more efficiently, puts out less heat.

4. What about oil consumption? Because AeroShell Oil W helps provide a cleaner engine and less wear, you can expect less oil consumption.

5. Can AeroShell Oil W reduce maintenance costs? If you have been using a straight mineral oil, AeroShell Oil W can reduce your maintenance costs substantially. Isotermals between



Left: Piston from engine using straight mineral oil after 1,000 hours: note sludge and ash. Right: Piston from same aircraft after 1,000 hours on AeroShell Oil W.

engine overhauls can be extended.

6. How does this oil help respond from a cold start? AeroShell Oil W has an unusually high viscosity index. This guards against engine thickening of the oil when cold yet provides proper lubrication when hot. Results: easier starting, fewer wear-ups.

7. Is AeroShell Oil W thoroughly proved? Thoroughly. It's had millions of engine hours of flight tests.

8. Can AeroShell Oil W be added as a make-up oil? Yes. It is compatible with all piston engine oils now being used.

9. Is there more than one viscosity grade? AeroShell Oil W is available in three viscosity grades: 100 and 130 grades for large engines, and 80

grade for small engines where stringent aircraft oil grade 55, 65, or 80 is not really recommended.

10. Where is it available? At Shell Authorized Dealers everywhere. Any dealer will sell AeroShell Oil W if you ask him.

Technical bulletin on AeroShell Oil W will be sent at your request. Write: Shell Oil Company, 50 West 50th St., New York 20, N. Y.



A BULLETIN FROM SHELL—where 1,001 scientists are helping to provide better products for industry.

## Boyd Impresses Airlines as CAB Chief

By L. L. Doty

Washington — During his first six months as chairman of the Civil Aeronautics Board, Alan S. Boyd has impressed the airline industry as an able administrator who has quickly grasped the intricate problems behind the industry's current financial and traffic dilemma.

In an Aviation Week survey of airline reaction to the new chairman, airlines dealt with such as major airlines—concentrated on transportation—a field in which, recently, Boyd is a staunch supporter. They were more impressed that Boyd has made some bold and genuine statements in speeches which have not been followed by specific action but this chairman was satisfied in a feeling that it is still too early to make a final judgment.

Generally, Boyd emerged as an administrator who, in the words of one airline official, "has shown a sensitivity to the industry and a willingness to move to the case of major issues." Boyd joined the CAB as a member in December, 1959, and was named chairman by President Kennedy in February, 1961.

The survey disclosed no feeling that Boyd has introduced an isolationist policy that can be expected to reduce the face of the industry. In general, the impression is that Boyd has strength and the CAB is enabling it to act on issues before it with expedition.

### Smoothing Old Policies

On the other hand, there is general belief that Boyd has already rejected a philosophy, into the CAB which his speech will cut one of the traditional pillars of the past two decades. For example, Boyd told Aviation Week that he sees no need for granting any more major routes to domestic trunk line carriers beyond those under consideration in present cases. On the other hand, he does see requirements for the long-standing policy of strengthening smaller airlines in the industry.

One airline attorney said Boyd has shown a "tendency to lean all at once to more protection before he even attempts to deal with it." Another said that the chairman already has challenged the White House on "one carrier route." He said this may be an indication that Boyd will not be content to do less for requirements in industry regulation, no matter how politically involved a problem may become.

On the contrary, a casually felt that Boyd may be too "politically conscious" and may have a tendency to steer clear of more with political overtones. This feeling was particularly noticeable in cases involving representatives of certain countries, international routes.

This group was virtually unanimous in its opinion that Boyd had failed to take adequate action in the international field. One official said Boyd had been "disappointed" because he had published price verbal discussions that would not be made to protect U. S. flag

carriers against the competition of foreign flag carriers and "yet no action has been taken."

Another official, who stressed Boyd's record on domestic issues as "Grade A," said that Boyd was long overdue in improving the international situation, and said it was his opinion that Boyd appeared unwilling to move into the area where the Federal Aviation Agency, the State Department and the White House were pointing for a decent position in this field.

In a speech delivered last month in San Francisco, Boyd called for "clearer thinking" in the international field and said that "there must be recognition of our agreements and the conduct of all parties under them." Boyd told Aviation Week that Boyd's action will be guided by a study being conducted by the Board and by studies conducted under Project Horizon.

He said that there are too many things that are going on in the industry, but he was not willing to take on the problem because of the regional nature of bilateral agreements.

Boyd and his staff are the most, but he noted that, while such a solution is practically possible, it is not usually politically possible, and it is contrary to U. S. public policy.

Boyd does not feel that sufficient action is being taken to protect the industry because of the excessive requirements of air carriers. He emphasized, however, that foreign carriers should understand the "basis of the game" and that the industry of air carriers has been subjected to general continued demands of traffic from U. S. carriers.

Two Carriers Report Losses in First Half

Allegedly, American and British Airways last week reported net losses for the first six months of 1961, marking a first-half deficit of \$579,474 attributed to loss to international operations. Allegedly reported a net loss of \$271,577, but expects profits in the third quarter.

Boyd reported total revenues for the six-month period of \$43 million compared with \$48.5 million for the same period last year. International operations were more responsible for a loss of \$267,427 and domestic losses totaled \$311,977.

Allegedly showed a net profit of \$147,584 for the second quarter of the year compared with a net profit of \$460,756 for the same period last year. Loss for the first six months was 42.1%

# JT12



## WHAT WILL THIS VERSATILE TURBOJET DO NEXT?

Pratt & Whitney Aircraft's JT12(160) jet engine, which weighs only 436 pounds yet produces 3,050 pounds thrust, has demonstrated its versatility in a broad range of applications.

The world's fastest executive transport is powered by four JT12 engines. In military aircraft, it powers twin-engine and single-engine trainers, a four-engine utility transport, and a reconnaissance drone. A West German high altitude research glider will also use the JT12.

Add a free turbine, and the JT12 becomes a turboshaft engine, developing 4,050 shaft horsepower. Two of these turboshaft engines give advanced helicopters power to lift nine tons. The turboshaft version of the JT12 is also projected for VTOL aircraft.

A modified JT12 for industrial uses will supply power for pumps, compressors, electric generators—and can be adapted for ships and earth moving vehicles.

Whatever its application, the JT12's simple, rugged design ensures high reliability and easy maintenance.

**Pratt & Whitney Aircraft**

Division of UNITED AIRCRAFT CORPORATION  
EAST HARTFORD, CONNECTICUT



## De Havilland Trident Prepared for BEA Delivery

British European Airways has ordered 24 of the threejet de Havilland Trident, the first of which rolled out of the company's Hatfield plant recently (AW Aug. 14, p. 4). BEA also has an option on 12 more of the transports, although these would be delivered with a larger seating capacity. Passengers on these shortened Roth-Korber Jetty berths getting 1500 lb. thrust each.

## BEA Records New Profit Despite Problems of Phasing-in Vanguards

London—Efforts of Vickers Vanguard phasing in problems on British European Airways' costs have been "contained" and could be at least as \$5 million according to Airline 11.500, which is the cost of the airline.

Milner said BEA is still doing very well. He said the airline is the 400th, and that "this should be close to 1,000 lb." He added that with 18 Vanguard in service, "no less more complex than engines."

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ago. Total flight increased from 35,995 hours to 41,995 hours.

BEA currently is vying with British independent airlines that want to share in the introduction of the Trident, and the results of Air Transport Licensing Board decisions will have a bearing on BEA's future aircraft commitments, Lord Douglas said.

BEA has ordered 24 de Havilland Trident threejet short-to-medium range transports, the first of which has rolled out (AW Aug. 14, p. 4), and Lord Douglas said that that order will not be reduced. However, he pointed out that BEA has an option on 12 more Tridents "which we hope we can get 165." Ordered aircraft would be a Trident follow-on with larger seating capacity.

Lord Douglas said that BEA "would be placed in jeopardy" if all the costs applied for were granted to the independent.

Lord Douglas declined to comment on BEA's plans to seek to operate Vickers 101s as express helicopters between London, Brussels and Paris, either this or as "helicopters with the winter have reached a definite stage."

The airline's annual report noted that "several more years of development and as well success, before the Trident can be expected to enter into service but BEA believes that the helicopter is still the only one in the world which holds promise of being able to operate consistently self-sufficient scheduled services."

On the immediate financial outlook for BEA, Lord Douglas said results for the first four months of 1961 (1962 fiscal year) are "encouraging," with BEA, in common with other airlines, finding that traffic is failing to come up to expectations.

Traffic from the United States to Europe, an important factor in BEA's planning, has scarcely increased and at the same time capacity added by airlines in Europe has increased by one-fourth and has thus threatened "already fierce competition on international routes used by BEA," according to Lord Douglas.

Lord Douglas and BEA approve of plans for an authority to take over management of London's airport (AW Aug. 14, p. 6) but said costs for technical services should not be reduced by the government, as in other countries.

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## Varig Purchases Reak; Vangir Is Expected

Vangir Airlines of Brazil has purchased Reak Airlines, another major Brazilian carrier, to create a system covering some 100,000 mi. Each year, Varig bought 10% of the voting stock of Varig Airlines, the international division of Reak.

The latest acquisition, which is subject to approval of the government, gives Varig control of both the international and domestic routes of Reak. The government is expected to give its approval of the acquisition after President Juscelino Kubitschek previously had signed a pending agreement for the services of Reak, Varig and Transoceanic (AW July 17, p. 4) as a means of sustaining operating expenses.



**BS**

## **BRISTOL SIDDELEY AERO-ENGINE APPLICATIONS**

**Olympus turbojet powers...**  
Avon Vulcan, MiG 19, F-4 Phantom  
RAF TSR-9, Harrier, Sea King

**Pegasus turbofan powers...**  
Beechcraft P-12, V-10, L-10, L-11, L-12  
Fokker F-27, F-28, F-29, F-30

**Rapide turbojet powers...**  
Giant, Atlas, Conquest, Conquest  
Hawker, Hawk, Hawk, Hawk

**Olympus turbojet powers...**  
RAF C-130, C-130, C-130  
RAF C-130, C-130, C-130  
RAF C-130, C-130, C-130  
RAF C-130, C-130, C-130

**Viper turbojet powers...**  
RAF Viper, Viper, Viper, Viper  
RAF Viper, Viper, Viper, Viper  
RAF Viper, Viper, Viper, Viper  
RAF Viper, Viper, Viper, Viper

**Pratt & Whitney turbofan powers...**  
RAF P-1, P-2, P-3, P-4  
RAF P-1, P-2, P-3, P-4

**Thrust turbojet powers...**  
RAF Thrust, Thrust, Thrust, Thrust

**Gemina rocket engine powers...**  
RAF Gemina, Gemina, Gemina, Gemina

**Starliner rocket engine powers...**  
RAF Starliner, Starliner, Starliner, Starliner

*Airliners, transports, trainers, bombers, fighters, missiles, space probes—in service all over the world...*

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## AIRLINE OBSERVER

► Domestic trunkline coach traffic continued to swing upward during July as the dominant class of business handled by the airlines and with the introduction of new insurance rates (AW Aug. 24, p. 40), the gap between first-class and coach traffic is expected to grow even wider. In July, coach traffic accounted for 62.9% of all traffic handled by the 15 trunk carriers compared with 54.4% in July, 1965. For the first seven months of 1966, 61.2% of all traffic was coach, compared with 57.4% in the same period of 1965.

► Federal Aviation Agency is weighing whether to install at least one General Precision/Lockheed computer in an operational traffic control center if a device should be needed to help mask an Data Processing Control (DPC) system (AW Aug. 7, p. 40). The Lockheed computer bought by FAA was to form the heart of the aerial DPC non-automatic traffic control system, the first of which was to be commissioned in Boston next year, and of subsequent activity. But the computer also can be programmed for routine bookkeeping chores if necessary, to keep some of the agency's investment.

► With recent reduction of duty free allowance from \$100 to \$500, U. S. customs procedures already bogged down by tedious baggage inspection are expected to become even more time-consuming for arriving passengers at major U. S. airport gateways. New equipment, which applies to goods purchased on trips of at least 48 hr. duration, can be cleared no more than once every 36 days.

► Aeroflot chief Yegoriz Logozov claims that the Soviet transport is now at least on a par with "American capitalist companies" from the standpoint of flight equipment and passenger comfort aloft. Speaking from recently reported first-hand experience, Logozov was quoted in the Soviet press as outdoing the Sud Caravelle, the Douglas DC-8 and DC-7 for having "100% no no space to hang one's coat or put away one's hat. Sitting on economy class flights is extremely crowded." The Aeroflot chief also asserted that night-time road service or "Capitallist" buses is "not qualitatively superior to ours."

► First Vietnam VC-10 feelings has started pressure tests at full 9 ft. difference tail. With the exception of nose radome landing gear box, wing center and tail cone, entire fuselage is pressurized to 9 ft. Meanwhile, Vietnam Air Force has abandoned attempts to find a name for the VC-10 begins this past. It was was considered as a black falcon on its Vietnam but South Africa has taken that name to the Vietnam plane will continue to be known by its letter-number designation.

► Chances that Japan will win its long-sought Moscow traffic rights for Japan Air Lines under a proposed bilateral air transport agreement are still slim but the Russians are expected to offer a compromise plan which could be a first step toward commercial air service between the two countries. It is now considered possible that the Russians will offer the Japanese a route between Tokyo and Leningrad via Khabarovsk, instead of only as far as Khabarovsk, as originally proposed. It is also possible that Aeroflot will be willing to transport air flights at Chita and Khabarovsk instead of Tokyo, as originally desired by Moscow.

► Airline services stalled, waiting to a heavy maintenance loss in the first half of 1966, fell sharply last week as a market that was generally strong. During the week, half of last week, ratings of airline stock prices fell in almost 2.5 points in active trading.

► Crew of a Douglas DC-3, operating on a charter mission, in Budapest last month has been attributed to a "gross lack of discipline by members of the crew." An investigation found that the crew had made "one-third" turn and "one-third" turn. The investigation found that the crew had made "one-third" turn and "one-third" turn. The investigation found that the crew had made "one-third" turn and "one-third" turn. The investigation found that the crew had made "one-third" turn and "one-third" turn.

► Tropical Aviation Agency last week authorized the General Electric CT-18-1 commercial turboprop engine which will power the Boeing Vertol 707 and Sikorski S-61 helicopter.

## SHORTLINES

► British Overseas Airways Corp. will resume flights on Caribbean routes, beginning in October and resuming a peak in mid-December. The airline will operate daily nonstop Boeing 707 flights between New York and Nassau, and New York and Kingston and Montego Bay, Jamaica.

► Eastern Air Lines has received the first of 15 Boeing 720 jet transports scheduled to be delivered before winter. The aircraft will go into service Sept. 28 with one round trip daily between New York, Jacksonville and Miami.

► Lake Central Airlines reports a quarterly dividend of \$2.5 cents per share on its 6.4% preferred stock.

► Los Angeles International Airport reports 5.1 million domestic and international passengers passed through the terminal during the first six months of the year. Last year's figure for the same period was 5 million.

► Pacific Air Lines has reported a net profit of \$115,000 for the first half of 1966, compared with a net loss of \$223,000 for the same period last year. The airline credits the profit to new operating and scheduling decisions under the Civil Aeronautics Board civil awards rate. The airline set operating costs \$500,000 during the six-month period.

► Panagra reports a 13% traffic increase for the first six months of 1966 over the same period last year. Panagra passenger orders totaled 124.6 million for the period.

► Queen Empire Airways has begun construction of its new Boeing 767 to replace its old Queen Empire Airways. The new aircraft will be completed within four weeks.

► Trans World Airlines has asked Civil Aeronautics Board to approve a new route between Chicago and Cleveland and unrestricted operating rights between Cleveland and New York. Cleveland-New York flights now must operate on weekends at or west of St. Louis.

► Trans World Airlines reported 100% load factors in the month ending on the first two jet flights leaving New York for Los Angeles and San Francisco under the new 5700 roadrunner transport aircraft jet executive first class (AW July 24, p. 40).

## A look at what's ahead in the realities of space exploration

*Some predictions from Douglas—builders of Thor which has launched 80% of all successful U.S. satellites & space probes in the past two years*

Our mastery of space has advanced so rapidly that only distant possibilities doubt the moon and planets will know our footsteps within a few decades.

Already a vehicle capable of orbiting a 1300-pound payload, or dropping 4,000 pounds to escape velocity, or lifting 2,000 pounds to Mars or Venus is being built in the U.S. This is Saturn, taller than a 10-story building, with an initial thrust of 1.5 million pounds. Its second stage, under construction for NASA by Douglas, will use a cluster of liquid hydrogen engines of unique design.

The world knows a man can rocket into space and return. Can he survive for long periods? Douglas studies give a strong affirmative. Zero gravity and artificial G require further study. Problems in a continuous problem, but reports from Discoverer XVII, one of 46 space projects launched by the Douglas Thor series, show the third less serious than was first thought.

The cost of space travel? A little thought is making power, which Douglas engineers confidently predict, should cut the operational cost of a trip to the moon to about \$600 per passenger. Other power sources, already under study, may even give such views as Beta and Alpha Centauri to travel.

The DC-8 Jetliner, an example of Douglas zero-space leadership. Few of us will ever be lunar colonists, but growing millions are learning about a new kind of travel through the DC-8 jet.

Here is an airplane that slices through time at 10 miles a minute, opens the world to all who have an urge to get up and go places.

Next trip, the DC-8 jet, sleeker of which is the DC-10 Super Jet, fastest long-range jetliner in the sky.



Douglas is building Saturn's 2nd stage

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WESTLAND HELVEDERE, powered by two Night Goshawk N Gs, 2 ft tubous of 1,600 hp, each, could be revised for commercial use.

## British Study Increased Helicopter Use

By Robert J. Cichewa

London—Expanded use of rotary wing aircraft in Great Britain has been given new impetus in a series of developments led by recommendations for construction of a city-center heliport.

In past years, with emphasis on military use, the helicopter in the United Kingdom has been relegated to a relatively safe air transport status. Despite the use of freewheeling methods, signs that this situation will change are:

- Report of a Ministry of Aviation special committee, planning emphasis on three possible international helicopter routes along the Thames River.

- Negotiations between British Euro Jetco Airways and Helicopters for joint purchase of the Vertol 107 helicopter to start city-center service between London, Bermuda and Paris.

- Formation of a new authority to run London's international airport and the Thames heliport, when it eventually is constructed.

- Considerable progress on clearing the top jet axis of the Westland Helvedere, BVA's choice for city-center service when, and if, a production order is received by the Ministry of Aviation and the Helicopters.

The trend is encouraging, particularly in view of support by Minister of Aviation Peter Thorneycroft who, in a document of a White Paper on Civil

Aeronautics, extended that heliports are a necessity for "modern cities that want modern transportation." But there are a few holes in the dice:

- None of the Westland Helvedere has been blown out of proportion by excessive service on progress toward substantial reduction. The heliport comes from the Ministry of Aviation despite an ongoing Ministry experiment not long ago when a Helicopters was demonstrated from over London to the parliament without prior announcement. The Ministry issued two calls—both from residents who wondered what the big machine was. After the Westland has exploded over most admitted noise suppression device and has an advanced design of the aircraft under way, but will not lift off short order. The company has submitted to the Helicopters a tender on building 12 Helicopters for the British market in addition to BVA's letter of intent and these latter notes.

- Report of the planning committee, while encouraging, left the Ministry with recommendations for this situation of one, after two years of study, in effect delaying a firm decision pending a reevaluation of the three report on construction of a 600-ft high heliport was included with a caution that planning objectives would be "very good or satisfactory."

One method, which so far has re-

ceived no official consideration, is moving a single corner on the Thames to provide a reach made heliport. But the main problem here is the series of low bridges, which are inescapable, even by dragging superstructure and halting the vessel to the boats.

Despite construction of the helicopter of course, much to BVA's in the Commercial route planning. This is using Westland Helvedere is not well for large-scale operations, and is located near Battersea Park with north air command traffic landing in London's West End and on direct West London area is much closer the London and Westminster Bridges.

### No London Service

There is at present no scheduled helicopter service between the two international airports—London Heathrow (the main international airport) and London Gatwick (providing the City center), although operations have made in the past, reaching studies of scheduled operations at New York, Chicago and Los Angeles. Experiment in a major consideration calling for performance growth to 1,600 hp (estimated) and safety requirements, and the resultant design equipment.

Use more expensive British United Airways, must a helicopter demands with operating success, but mostly in for

ridge countries. Alan Beaton, executive managing director who, with Tadeo Arnesen, merged his firm with British United a year ago, is interested in scheduled services, both airport-city and city-center, but at the moment is inclined to think the Vertol 107's passenger capacity (16-25 on short haul) too small. He feels that that capacity would be cut to 15 for low density service and the costs would be enough the last factor.

(British Eurojet Airways) has said that, although there have been some doubts out the London Helicopters would be compatible with present local way, function form, "and possibly a bit higher."

Beaton, a helicopter pilot who on occasion has his own charter, is not alone about the industry in successful commercial service. "You need a good luck. And the market is high density, no falls and low fees. City-center convenience is a start, but it's just not enough."

Beaton is keeping a close eye on Airborne developments and considers that the machine for his company, if it ever jumps into the scheduled routes across the Channel. There are no letters of intent.

### Varied Operations

Great Britain's helicopter operations in the United Kingdom are modest and concentrate on charter and agricultural but they took a new turn with completion of an agreement with Royal Navy to train helicopter pilots at the Redhill Airport center. Progress will start in September with Royal Navy providing the air and ground maintenance and British United the pilots, equipment and classroom facilities under direction of Alan Green, operations manager.

Green already has a complicated job watching over helicopter operations except from Royal to Kenet and the Royal Air Force. Further expansion are all companies, although the Royal government has actual and covers no less to support Army operations. On the surface, the should have passed diplomatic problems during the British Royal operations but it didn't. Green is usually and much attention to the so-called lighting, but just for the dark screens at night.

Another highly successful operation is at the Island, but not in the Persian Gulf a few days ago in a boat to serve without drilling up. Another operation headquarters is in Bermuda, new contract work in the Caribbean and Africa.

The company has an Hiller 120s in order the first now includes 15 Westland, 25 Hiller, 7 Bell 47s and 14 Vertols. Its most recent acquisition is purchase of the helicopter



PROTOTYPE PHOTOGRAPH, shows on one of its test flights, is powered by Elfin engines. Following version would have four engines and use sound suppression device.



BRITISH UNITED AIRWAYS Helicopters based at the Westland heliport in Battersea. 140, post a scheduled transport and a used study for charter pickup and delivery.



POSSIBLE CITY-CENTER HELIPORT, designed for use of the Westland Helvedere, is a conception of the manufacturer for connection with a rapid transport.



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## Proposed London Heliprot Sites

Comparison of four proposed heliprot sites based on journey by rail/motor

SITE	PER HOUR	PLANNED HELIPT STATION	NUMBER OF REPRESENTATIVE CARS OR PASSENGERS	ROUTE FEATURES		ADVICE TRAVEL TIME (MINUTES)		PUBLIC TRAVEL COST
				Development within 12 miles	"Ideal" distance along flight route	Reaches Station	Reaches Home	
<b>NEW BANGS</b>	10 (Peak 10 to 12 working days)	10	100	Population: 1,000,000 Distance to London: 40 miles (100 miles)	100 miles 1,000,000 ft	10-15	15-20	No underground station due to low cost. Self Victoria Tube Extension which is under construction is under way.
<b>NEW BANGS STATION</b>	10 (Peak 10 to 12 working days)	10	100	Population: 1,000,000 Distance to London: 40 miles (100 miles)	100 miles 1,000,000 ft	10-15	15-20	Underground station due to low cost. Self Victoria Tube Extension which is under construction is under way.
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may of Chertsey Helicopters & Co., Ltd., a shipping and handling company which owned three Westlands.

BHA has been operating its Helicopter Express since 1947 and currently has a Bell 47B1, a Bristol 187, two Westland Sikorski S-55s and an Agusta Bell 47G, all based at Gosport, the charter and aircraft work. BHA was a partner in a company called the United Kingdom for the Coastal Port Office and has conducted a number of all-weather test programs for the Ministry of Aircraft at the Royal Air Force, Farnborough.

Another helicopter development is exploration of the value of the British Cessna, an aircraft designed for the transport of passengers and cargo. The Cessna, Ltd., and its parent company, the British Cessna, Ltd., at Lynton Airport, Bristol, is now working on a project to develop a helicopter for the transport of passengers and cargo. The Cessna, Ltd., is now working on a project to develop a helicopter for the transport of passengers and cargo.

self-contained with a vehicle and trailer for towing and servicing, and simplicity of maintenance.

Pro Helicopter Industries was formed in 1958 to provide a helicopter for a military base, using a Bell 47B1, which was then operating from Woburn, Bedfordshire. It has since moved to the Helicopter Industries, which was then operating from Woburn, Bedfordshire.

Another move in the helicopter field is the introduction of a new helicopter, the Helicopter Industries, which was then operating from Woburn, Bedfordshire. It has since moved to the Helicopter Industries, which was then operating from Woburn, Bedfordshire.

### Only Manufacturer

British only helicopter manufacturer is Westland Aircraft, Ltd., which builds the Scout, Whirlwind, Wessex, and the new engine-driven, all-terrain, all-weather, and has been flying the Westland prototype for some time. The Scout is a helicopter for the transport of passengers and cargo. The Whirlwind is a helicopter for the transport of passengers and cargo. The Wessex is a helicopter for the transport of passengers and cargo.

The Wessex is a helicopter for the transport of passengers and cargo. It has since moved to the Helicopter Industries, which was then operating from Woburn, Bedfordshire.

and that are able about 50 engineers and technicians now working on the design. He thinks up to 500 million a year should be spent on development for the next 20 years to make the full benefit.

The main of transport was not considered by the Committee on Planning of Helicopter Services in the London area. However, the group is interested in a rapid platform, like the Thales, but said it made no attempt to assess precisely the cost "since this is a matter for the government, but the capital cost is likely to run into tens of millions."

Present Westland helicopter was considered too small, although the committee noted that in its first year the helicopter needed 1,000 movements with peaks of 30 in one day. A commuter project of 10 scheduled operations could be 1950, produce 900,000 passengers a year, or 1.5 million passengers in 1975 with 15 scheduled aircraft.

Minimum operational area needed for a city-center helipad will be about five acres for five movements an hour, or about eight acres for 15 movements per hour. Single helipad of 12 acres should be capable of handling traffic into the 1970s.

Three sites referred to by the committee are:

• New Elton goods yard, which would have a 10-acre platform over part of



## Let's talk impulse in space

Toxic chemical propellants will often find their most useful applications in upper stages, for course or orbit correction and timer loading or take-off by safes compared at  $P_g=0.2$  psi have a different relationship than when compared at  $P_g=14.7$  psi, such an approximation of "space" conditions gives a much truer picture of the relative performance of propellant systems we present (from Gallery's new booklet—Propellant Performance Data) a few excerpts to illustrate the point. As the U.S. standards on LOX-RP, LOX-LH, and solids, there is still considerable merit in storable liquid systems for specialized jobs in space.

PROPELLANT SYSTEM	SPECIFIC IMPULSE	
	(Sea Level 1000-14.7)	(Space 1000-0.2)
$H_2-O_2$	391	470
$H_2/LH-O_2$	387	466
$O_2/LH-F_2$	360	440
$N_2/LH-F_2$	363	436
$N_2/LH-O_2$	327	421
$O_2/LH-NH_3$	324	412
$N_2/LH-H_2O_2$	314	400
$N_2/LH-N_2O_4$	304	391
$N_2/LH-ClO_2$	304	390
$RP-O_2$	309	379
$N_2/LH-ClF_3$	290	360
$N_2/LH-N_2O_4$	291	364
$ClH_3-N_2O_4/ClO_2$	274	349

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### Gallery Chemical Company, Defense Products Department

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**ARTIST'S CONCEPTION** is of 600-ft. high helicopter made of concrete. Elevator would run, powered up, the control column in the helicopter pod.

the, cutting goods deep on the south side of the Tennessean, upstream from the Vertical Bridge. Site has a wide range of unobstructed approach and takeoff action.

• Cannon Street station, built on the station rooftop on a three-acre site, with a platform extending the site to 77 acres.

• St. Katherine's Dock, near Tower Bridge, would require a 540-ft. high platform to avoid cranes and other structures but would have a high structural of stability for both single- and multi-engine helicopters.

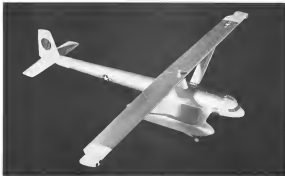
#### Site Evaluations

Compton said New Elbow and Cannon Street are "terrifically well placed" to serve the West End and the city, but St. Katherine's Dock is "too far" from the West End to be convenient for the majority of passengers.

Referring to the high tower type of helicopter, the committee noted that such a structure (standing about 116 meters) would meet the skyline and would conflict with city office planning requirements and would take four years to build. Not mentioned specifically, but a valid objection to operation would be flights during low ceilings, often much lower than 100 ft., which plague central London during winter months and also past prime London fog.

Compton was appointed in 1959 and was succeeded by G. I. Morris. Morris included representatives of British European Airways, London County Council, British Transport Commission and the Ministry of Aviation.

## AERONAUTICAL ENGINEERING



**SHORG** (Self-Ferrying Tennessee Rotary Wing Concept), would be convertible on the ground to a fixed-wing configuration.

## Large Crane Combines Fixed, Rotary Wing

By Russell Hawkes

Large flying crane helicopter which can be converted on the ground to a fixed-wing configuration for transoceanic range ferry flights has been proposed to Defense Department by Hiller Aircraft Corp.

Hiller calls the proposed dual auto-

gen aircraft the Shore (Self-Ferrying Tennessee Rotary Wing Concept) and designates it Model 1096. Congress officials agree that the need for a flying crane, at least two years but not less than in the past because of the difficulty of transporting them, occurs quickly and occasionally. Helicopters have not had enough range to be forced across

the ocean because of their aerodynamic inefficiency. Lift-drag ratios of helicopters are about a quarter of those for fixed-wing aircraft. The Shore concept would convert this by forming an efficient glider over and loading the rotor in position to serve as a fixed wing. Conversion to flight is not part of the idea.

Hiller officials believe the helicopter

**HILLER's crane** would be operated by tip-mounted turboprop engines for both rotary and fixed-wing operations.



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REFERENCE & TRADE DIVISION: General Office, Allentown, Pa. 18020; LOCAL OFFICES: Baytown, Tex.; Wilmington, D. C.; Los Angeles, Calif.; Winter Park, Florida.

of the large Russian MiG-29, says that at Tuolosa will prompt U.S. efforts to a reevaluation of the firing cone concept (AW July 14, p. 30).

The proposed Stow would be powered by tip-mounted turboprop engines for both rotary and fixed-wing operations to eliminate the weight of rotary-wing gear trains. Helicopter engineers say variable engines now cause the rotor tip installation on helicopters of this size and are specifying the Continental J60T-79 for the Stow.

They believe trends in helicopter design are also producing trends that make a convertible aircraft feasible. They have not made the helicopter more efficient but bigger ratios of power to weight have produced larger rotor blade areas. If blade area approaches the wing area of fixed-wing aircraft of the same payload size, the Stow becomes inherently feasible. It is expected to share more 80% of the loads which have caused the military services to reject just flying crane designs. Helicopter engineers estimate that as the rotor and gearbox diameters of helicopters increase to grow, optimum blade area and blade aspect ratio will approach the area and aspect ratios of fixed wings.

Design compromises avoided in the Stow concept are called rotor. The main one seems to be the necessity of using an untwisted, unswept airfoil which induces rotor efficiency by a few per cent. Such an airfoil must be used because the convertible blade in use configuration will be upside down with respect to the other configuration. The untwisted airfoil does not produce helicopter performance because wind helicopters have a nonrotated airfoil anyway to get a fixed center of pressure. Such compromises to the choice of airfoil size and blade area will probably have to be made to get the optimum

balance between airplane and helicopter design features.

The Stow is envisioned as a means of moving heavy equipment and supplies in the combat zones of a small war area.

The truck deployment from the continental U.S. to the Stow would be flown as an airplane to a prepared airfield within 50 or 100 mi. of the combat zone, then moved to a helicopter and loaded with fuel for flying crane operations.

#### Conversion Procedure

Conversion from helicopter to airplane would be performed by disconnecting wing struts, raising the wing, dropping it flat and aft, and preconnecting it. The struts would then be folded upward and aftward. In a separate act, hauled to the hub to help carry the loads on it. The rotor blade would be turned over, the control system would be rotated, and the hoists in tail box would be opened to permit helicopter directional control. Forward loading gear mounted in wide-speed configurations are prepared to leave the rotor directly under the fuselage and the rotor hub suitable for a load of cargo in a rack, as a pallet, or in a crisscrossed pod. The wing-mounted engines would need to make a problem in installing asymmetric thrust if an engine were to fail in the fixed-wing configuration. Aspect ratio of the Model 1095 Stow is set at 14:1. This is more conservative than that of the Tuolosa-built fixed-wing Huey/Dobson H-12 short field transport. As an airplane, the Model 1095 would have a maximum gross weight of 77,000 lb and as a helicopter, it would have a maximum gross weight of 65,000 lb. It would have an airplane wing loading of 70.6 psf and a helicopter disk loading of 5.5 psf.



## Engineered Environment

The flexible steel need of the gutter was a first of engineered environment as well as priority. The machine was carefully patterned, thousands of articles of steel plate and sections from inside the need to that an one circulate around them. This machine power handling for better during the hot, dry weather.

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#### TCA DC-8 Flies With Five Engines

True-Classic Air Lines orders spare engines from its main engineering and maintenance base at Montreal to four distant bases in quick rotation to mounting the fifth engine in a pull on the centerline of the wing midway between the left and right engines and the fuselage line the vertical between the 104th long Bolls-Berry Converter jet engines which power the DC-8s, are too large to be accommodated into any of the other TCA aircraft.



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### VEHICLE FLIGHT CONTROL

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Integrated  
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**TAPCO**

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## PRODUCTION BRIEFING

**Avionics Corporation** (Hawthorne, Calif.) plant will supply **Aerospac** General Corp. with \$131,000 in components, including turbine valves, for propellers systems of Air Force Three main engine.

**Bids** for constructing an equipment testing and maintenance laboratory in the nuclear rocket propulsion experiment area of the Nevada Test Site will be opened at the Atomic Energy Commission's Las Vegas office Sept. 19. Plans and specifications for the building, to be a single story steel of concrete and masonry block, will be available about Aug. 31 from Helms & Naves, Inc., Special Projects Division, 549 S. Broadway, Los Angeles 14, Calif.

**Avonics International** is building a rocket engine to replace rocket engine fuel for the Air Force Systems Command. Cops will be used in Silicon Valley's 518RD Test Group in 10 north ATD.

**Aero Corp.** will build three rocket-powered nose cone for the flight test of a Scout, use for use as a backup payload and use for laboratory ground rocket testing—for the National Aeronautics and Space Administration. The tips, each containing 25 thermocouples for temperature measurements will be used in conjunction with rocket motor studies.

**Huffman Electronics Corp.**'s Military Products Division, Los Angeles, has received an Air Force contract, including \$1 million for additional 864 TACAN (Tactical Air Navigation) sets.

**United Technology Corp.** has received contracts from Air Force's Edwards AFB for research and development of an advanced high performance solid propellant and from the Office of Naval Research for research in thermodynamic of the high-energy flame bond. Dollars value of the two contracts is about \$170,000.

**Barthelme Co., Anaheim, Calif.**, will produce field maintenance test equipment for the H-16 nuclear power engine under \$2,011,195 Air Force contract. The contract will run from June, 1961, to August, 1962.

**Dreyfus** (Cincinnati) will supply avionics electronics will be produced by Tropic Electronics and Machine Co., a subsidiary of East Texas Electronics Inc., Dallas Tex., under a contract from Parkway Aircraft, Dover, N. J. Components will utilize shock-tanning techniques to manufacture components.

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# *the breath barrier...*

**TO MEET THE LIFE SUPPORT REQUIREMENTS** of long-duration space flights, a comprehensive, re-generable environmental control system will be needed. The primary design parameters: extreme reliability plus simple modular construction for easy maintenance. In addition, minute flow rates of liquids and gases must be metered under zero gravity conditions . . . improved components must be developed to prevent even infinitesimal leakage . . . proven techniques in systems dynamics and integration must be applied to assure dependability.

**CURRENT HAMILTON STANDARD WORK** in space life support is based on the use of many components which are presently within the state of the art. The entire space ECS design includes . . .

- a thermal control subsystem which utilizes a transport loop with aqueous ethylene glycol coolant to provide heat rejection to the ultimate sink.
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- a partial and total pressure-control subsystem, operating from cryogenically stored fluids to provide a normal environment without special clothing.
- instrumentation for monitoring all significant variables, plus emergency annunciation.
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**IN AN INTENSIVE PROGRAM** begun three years ago, Hamilton Standard has already developed, built, and tested some of the basic equipment to be used. Moreover, a vast pool of fundamental research data has been accumulated which will greatly facilitate production of the system. This work is a logical evolutionary extension of experience that Hamilton Standard has amassed in the production of ECS for such advanced aircraft as the F-104, B-58, and B-70 —the most comprehensive system ever developed for manned flight.



**CO<sub>2</sub> REMOVAL UNIT** could, in present form, sustain three men in a modest capsule indefinitely. Several of these units, have already accumulated hundreds of hours of testing. One assembly, operating under a 3-man load in the Moon Room, recently passed 160 hours of continuous endurance testing, and is scheduled for further tests by NASA.



**MOON ROOM**, a 500 cubic foot closed environment laboratory, simulates isolated-cabin conditions for up to five men. Here, Hamilton Standard has performed development tests involving weight, configuration, volume, power requirements, and reliability of a variety of space ECS equipment.

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### Oxygen Mask

Lightweight oxygen mask made of silicone rubber provides greater safety and reliability for military crews firing lightweight aircraft. It was developed for the Air Force jointly by Union Carbide Corp. and General Tire Corp. Mask weighs only 11 oz., has positive seal at extruded struts and is especially easy to don and doff.

### Film Reader

Computerized film reader converts X-ray coordinates of points in surface photographs to digital data. Automatic alignment of film panel and camera sensor is effected by optical sensor and dropper; the latter transferring split sensor images emerging from the sensor assembly onto digital unit plates. Plates are presented on continuous in-line film and film plates, then scanned by air track, until wave fronts coincide. For stock movements are recorded as X-Y coordinates and results are printed out either on tape or card. Company says reader, which also features automatic exposure, is adaptable to analysis of continuous motion images.



run on satellite orbit photography. Accuracy: ±3 meters. Power: 115 v., 60 cps, 21 amp max. Dimensions: 71 in. tall, 66 in. wide, 93 in. long. Weight: 1,800 lb.

Hansen Electronics Division of Itek Corp., Cambridge, Mass.



### Low Leakage Cryogenic Valves

Minutaur cryogenic valves feature hardened seat for longer life and range from 100 psi to 4,000 psi in capacity. They will operate from -473° to +100° F. Functional tests using 1,000 actuations at various temperatures showed zero leakage at the 70° range with leakage in low as 3 cc at -300° at 1,000 psi.

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### Pulse Bomb

Contract release impulse bomb is intended for laboratory determination of liquid or noncompressible solid propellant performance and for quality control testing during propellant manufacture.

The Model 661 impulse bomb has a nominal volume of 1 cc. in. and is rated for a maximum working pressure of 30,000 psi. The stainless steel bomb is complete with firing circuit and pressure transducer requiring only a recording system to record output.

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... EXTRUDED**

The aluminum extrusion in the picture is a metal-working "first" it is 18 1/2 in. wide and has 24 internal passages running its entire length. Passages are 3/8 in. wide, 1/4 in. high and spaced 1/4 in. apart.

The extrusion is cut to required lengths to form panels. The panels are made into pressurized cabinets that house electronic equipment for high-altitude aircraft. Cool air forced through the passages air conditions the equipment for greater operating efficiency. These panels or similar extruded parts could also carry gases or liquids to overcome heating or cooling problems in other applications.

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This extrusion "first" is a significant example of Alcoa capability at work. Alcoa... where the men, the metal and the machines can roll, forge, extrude or cast the solution to your metal problems. How can we help you use the capability? Write, Aluminum Company of America, 1870-V Alcoa Building, Pittsburgh 18, Pennsylvania.

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**Planar testing of critical tubing.** 1/2" to 4" O.D. with eddy currents. Magnaflex PW-400 is used here for both research and production testing of stainless steel and aluminum tubing. It is one of a line of Magnaflex units lacking nonmagnetic tubes, rail and aircraft systems, valves, semiconductor parts, embedded wires, drives, fans, etc. Defects are reported on the scope and/or visual display, as well as on a printout, if necessary.

Photo courtesy of NDTA, Inc. - Air 001-0001-0788



**Planar testing of rocket motor end bell chambers.** This specially constructed and designed Magnaflex unit provides multi-dimensional images to detect gross defects at all angles. It is designed to detect gross defects and is ideal for inspection of highly critical components and parts. Magnaflex does not require an operator to be present at the controls of the unit. It is one of a line of Magnaflex units designed for use in a wide variety of industrial applications.

**NDT\*:** Nondestructive Testing works best  
and saves you most when it is planned for  
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NDT can help assure reliability of your finished products, of course. But your greatest benefits come when adequate testing considerations are introduced as early as possible in the R & D and design stages, with more thought given to fitting solutions than fitting arbitrary specifications. It is no longer enough to keep defective parts and machines off the launching pad, or out of the engine—or even out of the production line. Test practices must consider the need of the end use of the item, using the best test method, regardless of its type.

Such benefits in reliability—and production savings, too—can be realized every day, with Magnaflex Test Systems planned for and used at every stage from first concept to full production testing. Whether for large volume, or low-volume critical parts, or prototypes, Magnaflex offers you the widest variety of different test systems and methods.

A few typical examples are shown here. Many others could be. For your own requirements—however commonplace, critical or specialized—there is usually a Magnaflex Test System. Call your Magnaflex Field Engineer—or write Magnaflex Corporation, 1308 W. Lawrence Avenue, Chicago 31, Illinois.



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**TEST SYSTEMS**

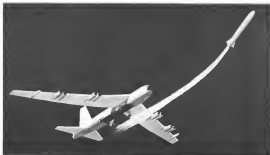
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**Planar testing of bearing cages.** This is a specialized, automated Dye Penetrant Inspection System with which one man tests up to 100 endurance bearing cages per hour for cracks, stresses or leaks. It includes specially designed handling and programmed processing, custom engineering and built-in Magnaflex. Parts tested range from 1/2" to 10" O.D. Twelve different Dye Penetrants have been developed by Magnaflex to produce precise, 100% reproducible results, assure sensitivity in most all needs.



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ARTIST'S CONCEPT shows how the Boeing B-52 with first landing gear could be utilized as a convertible first-stage booster for future orbital launches. In some configurations studied the landing gear could be jettisoned.

## B-52 Use as First-Stage Booster Studied

By Ernie J. Bohan

Wallops, Kan.—Use of the Boeing B-52 Stratofortress bomber as a convertible, first-stage booster having a proven reliability in approach legs, vehicle vehicles and their payloads in being considered by the U.S. Air Force.

Boeing-Wallops engineering studies indicate that the aircraft booster has the speed, altitude and payload capability of taking reinforced booster payload combinations of more than 150,000 lb., using the considerable cost of first-stage booster payload plus having the ability to launch from optimum sites to achieve desired orbits rather than being restricted to present ground-based facilities.

### Initial Presentation

Initial presentations before the Air Force have aroused sufficient interest regarding the results of the studies that Boeing-Wallops has been requested to submit detailed studies pertaining to specific USAF programs. Indications are that the Air Force is interested in using the B-52 launch platform for its Blue Scout research rocket. Boeing believes that its system can make possible launches of Blue Scout vehicles carrying large payloads, or launching them with current payload capacities using boost stages.

Its studies indicate that the B-52 could have boosted even vehicles launched in orbit except the Discoverer vehicles, and Sprinter, and those which are a part of own mission programs.

### Booster Stage Pickup

The defense manufacturer also notes that the B-52 could be utilized in picking up booster stages or complete vehicles at contractor sites and ferrying them to launch or prelaunch takeoff sites at existing or cost and time over present surface airfields. Thus far, however, presentations have concentrated only the savings in costs of first-stage booster, including availability of the B-52, and have not considered the additional savings gained in transporting the booster or vehicle or the fuel costs and facilities required in additional "Cape Canaveral" launches. Westinghouse.

The Pratt & Whitney TF-33 turbofan-powered B-52D is considered as an optimum vehicle to be launched in orbit because of its range, payload and speed capability, but Boeing-Wallops engineers feel that the B-52 and G-3, or possibly earlier models are also adaptable to the program since launchings would be planned to overcome weather problems. Some detailed discussion of the single-stage thrust capabilities by itself would tend to disqualify B-52

version system characteristics, only general data, not identifying a particular version of the Stratofortress are available.

Basically, the Stratofortress could air-launch from over 11,000 ft. to well over 50,000 ft., leaving the heaviest payload at the lower altitudes.

This could be accomplished with the aircraft landing at approximately 175 kt TAS.

Carrying the heaviest payload—considered as the "over 150,000 lb. class"—the Stratofortress could launch and would have at least five hours of flight time, which would include on time of launch, unrefueled.

Boeing is realizing could extend the aircraft's mission capabilities considerably.

### Payload Configuration

Depending upon the payload configuration and weight, the aircraft can be modified for various storage—storing. Hound Dog or to surface waste water using missiles, carrying the vehicle at the wing and in an "airdrop" location, or centrally mounting it in the belly. The latter location is favored because it reduces need for reflecting conventional loading and drag and makes possible design of much of the vehicle inside the belly, thus providing some access to it prior to launch, would require being

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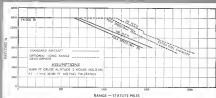
# BAC ONE-ELEVEN

## THE SHORT HAUL JET

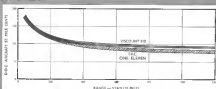
- 540 m.p.h. cruise speed
- 97 mixed class or 69 tourist passengers
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- Cabin width for spacious five-abreast seating
- Range of over 1,100 miles with full 14,000 lb payload

BRITISH AIRWAYS HAS CHOSEN THE OPTIONAL LONG RANGE DEVELOPMENT OF THE STANDARD AIRCRAFT

### PAYLOAD - RANGE



### ECONOMY



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the main landing gear to prevent wing lock-up with the payload.

In spite of the costly aircraft traded, the Boeing gear could be selected, given along the forward gear was selected ahead of its present location. One level placed it directly behind the cockpit. Additional modifications could provide accommodation for hydraulic and accessory ductwork and some dry-rot equipment in the fuselage of the mother plane.

The company, notes that it and the Air Force already have considerable experience using the B-57 as a "test stage" for introducing the N-15 to a new aircraft and that the airplane is also prepared to carry the Boeing Dyna-Son test vehicle for its initial test program. Boeing-Walton is carrying the testing of the latter vehicle for glider program and powered flight prior to introducing the Dyna-Son test vehicle.

## NASA Contracts

National Aeronautics and Space Administration awarded the following contracts and research grants during April, 1961. The figures shown represent the total estimated cost of contracts of \$50,000 or more let during the period.

**HEADING: AERONAUTICS, WASHINGTON, D. C.**  
1. **University of Toronto, Toronto, Ontario, Canada.**—\$10,000—Research in connection with the University of Toronto on aerodynamic effects of flow in the transonic regime.

2. **General Electric, Hartford, Conn.**—\$10,000—Research in connection with the University of Toronto on aerodynamic effects of flow in the transonic regime.

3. **General Electric, Hartford, Conn.**—\$10,000—Research in connection with the University of Toronto on aerodynamic effects of flow in the transonic regime.

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Dept. of the Navy, Bureau of Medicine and Surgery, Washington, D. C.—\$10,000—Research in connection with the University of Toronto on aerodynamic effects of flow in the transonic regime.

10. **General Electric, Hartford, Conn.**—\$10,000—Research in connection with the University of Toronto on aerodynamic effects of flow in the transonic regime.

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31. **General Electric, Hartford, Conn.**—\$10,000—Research in connection with the University of Toronto on aerodynamic effects of flow in the transonic regime.

## A REPUTATION BUILT ON SERVICE



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Aerospace components built by Lavelle meet highest performance requirements. Lavelle services are equally matched to your special processing needs. For over two decades, Lavelle's policy has been to serve as an integral part of your production team for prompt delivery of reliable components at reasonable cost — only on a reputation built upon service. Rely on Lavelle.



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WELDING • MACHINE SHOP • METAL FINISHING • QUALITY CONTROL)



LAVELLE AIRCRAFT CORPORATION • NEWTOWN, BUCKS COUNTY, PA.  
Branches: Philadelphia, Pa., and Troy, N. Y.







pany funding of research and development programs pulled down net earnings. Generalized and backlog of orders on June 30 was \$275 million; it was \$115 million the year previous.

**Chance Vought Corp.**, Tulsa, Tex., net income for six months ended June 30 totaled \$5,561,751 or \$1.21 per share, an increase of \$91,250,271, compared with a net income of \$5,591,544 or \$1.24 per share on total sales of \$114,895,982 for the same period the year previous. Chance Vought President Clifford K. Johnson noted that a reduction of \$400,000 in overhead and income taxes applicable to 1969 partially offset a provision of \$350,700, net of taxes, for impairment of investment in an unconsolidated subsidiary. He has reflected in the six-month statement. A dividend declared has been declared payable Aug. 22 to holders of record on Aug. 7—the dividend covering only July and August has been paid. Johnson said that the dividend, since Aug. 11 is withheld as the closing date for sale of stock of the corporation in Long-Term Electronics, Inc., in the merger agreement between the two companies.

## New Offerings

**Hytron Corp.**, Torrance, Calif., engaged in the design, development and manufacture of high strength and close tolerance fastening devices and fastener assembly systems for the aircraft and missile industries. Offering in 1970, 500 common shares, \$5.00 shares for public sale by the company and 50,000 outstanding shares by the present holders of the company. Of the company's proceeds, \$350,000 will be applied to discharge its \$100,000 bank loan and to construct two new buildings for engineering and laboratory work and research, development and processing of exotic metals for use in its products.

**Applied Research, Inc.**, Port Washington, N. Y., engaged in the design, development, manufacture and sale of electronic systems for the defense and aerospace markets. Offering in 1970, 500 common shares, \$5.00 shares for public sale by the company and 50,000 outstanding shares by the present holders thereof. Proceeds of the company's sale will be used for leasehold improvements and for additional production machinery and test equipment; the balance for general corporate purposes as required.

**Dynalco Microwave Co., Inc.**, Miami, Fla., 37 Yr. 2, the construction and installation are engaged in design,

construction and sale of microwave components, test equipment and test systems in civil and research and development in the field of microwave energy. Offering in 1969, 500 shares of common, for public sale on an all or none basis. public offering price and underwriting fees to be supplied by shareholders. Proceeds will be used to repay bank obligations incurred for working capital purposes, for research and development, for increased advertising for additional equipment and materials; the balance will be added to the company's general funds, and will be used for development and production of "semiconductor" and "solid-state" microwave units and, as required, for working capital purposes such as raw material purchases and payment of trade accounts and the like.

**Westinghouse Engineering Service Corp.**, Inc., Bedford, Mass., offers a variety of services for engineering, professional and manufacturing companies which are provided on a project basis and include a Service Maintenance Program, Design/Build/Service Program, Training and Training Materials Program, and Installation/Maintenance Program. Offering in 1970, 500 shares of common stock, for public sale at \$1 per share. Proceeds will be used for leasehold improvements, to pay current bank and other notes payable, to working capital to be used to pay employee compensation during a 30- to 90-day interval between the time the company performs work on its various contracts and the time that it receives payment therefor.

**Airtronics International Corporation** of Florida, Fort Lauderdale, Fla., engaged presently in the manufacture of electronic, mechanical and electro-mechanical radar and missile system parts and components under subcontracts with United States Government agencies, and governmental contracts including electrical and machine work. Offering in 1970, 500 shares of common stock, 100,000 shares for public sale by the company, and 50,000 outstanding shares by the present holders thereof. Proceeds of the company's sale will be used to pay current advances from banks, to repay 15% notes payable; the balance will be added to general funds and will be available to pay a portion of the cost of constructing, equipping and furnishing the proposed office of new company's plant. Any remainder will be used as working capital.

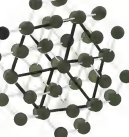
**National Semiconductor Corp.**, Dallas, Texas, is engaged in design, development and sale of semiconductor

has been in the development stage for the greater part of its existence, having been in commercial production since the fall of 1968. It is engaged in the design, development, construction and sale of quality transistors for military and industrial use. Offering in 75,000 shares of capital stock for public sale, public offering price and underwriting fees to be supplied by shareholders. Offering also includes 177,700 capital shares to be sold to officers and employees upon exercise of options granted or to be granted under the company's Employee Restricted Stock Option Plan. 15,000 capital shares for subscription by officers and employees under its Employee Stock Purchase Plan, 210,855 capital shares to be issued upon conversion of outstanding 8% convertible subordinated notes. Proceeds will be used for the acquisition of capital equipment for production and test, for improvements to leased production facilities for testing, (a) required assets to expand its capacity, the balance for general corporate purposes, principally the acquisition of R&D staff and equipment.

**Eastern Air Devcon, Inc.**, Dover, N. H., engaged in the production of power components and wire components including wire and wire technicians. Offering in 150,000 shares of common stock for subscription at \$1 per share by common stockholders of General Petroleum Corp., its parent, at the rate of one share paid for each \$10. Current shares held, none due and underwriting fees to be supplied by shareholders. Of the proceeds, \$675,000 will be used to meet the company's obligations incurred in the purchase of certain machinery and equipment which had been under lease to the company; the balance for general corporate purposes.

**Pacific Air Lines, Inc.**, San Francisco, Calif., engaged in the air transportation of passengers, property and mail, serving 13 cities through 15 airports in the states of California, Nevada and Oregon. Offering in 151,500,000 of 64% convertible subordinated debentures, due 1975, and 150,000 shares of common stock, for public sale in units, each consisting of \$100 of debentures and 10 common shares; public offering price and underwriting fees to be supplied by shareholders. Proceeds will be used to pay certain accounts payable incurred in connection with the purchase of new aircraft, spare engines and parts, the modernizing and upgrading of aircraft, and installation of radio equipment; the balance will be added to general funds and used as working capital and for general corporate purposes.

How Science Serves Defense at Westinghouse . . . Molecular Electronics



## MOLECULAR ELECTRONICS PROGRESS AT WESTINGHOUSE: COMPLEX SYSTEMS MADE WITH MULTI-FUNCTION "BLOCKS"

Multiple electronic circuit functions in microscopic solid-state and successful combinations of these tiny structures and systems—have actually been accomplished in the Westinghouse molecular electronics program. Examples include an operating UHF communication receiver, a 5-bit binary computer unit, and a digital guidance receiver. Although still in early development, these examples are working demonstrations of molecular electronics systems. They indicate exciting things to come in this revolutionary new field.

Primary goal of space-saving molecular electronics is system reliability . . . functional electronic blocks have fewer components and interconnections . . . less power is needed, less heat generated . . . redundancy is simple to achieve.

Working under an Air Force contract, Westinghouse scientists have invented tiny molecular blocks to do many sophisticated electronic jobs. They have made new semiconductor materials, grown crystals in ribbon and layer, and developed the industry's most advanced techniques for fabricating circuits in molecular blocks.

Pioneering on this important field is another of the many ways science serves defense at Westinghouse. Defense Products Group, 3520 Connecticut Ave., N.W., Washington 6, D.C.

Westinghouse



Three of many functional blocks: top center, a "true state" and "gate" amplifier; bottom center, a 50-MHz video amplifier for video image transfer; bottom left, an image transfer circuit; bottom right, a 10-MHz video amplifier.



Hybrid molecular electronic UHF receiver, being developed for the Air Force, was designed with specifications of the AN/APC-50 as a guide. Gamma operating below 40 MHz are constructed with silicon Schottky blocks.

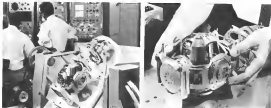


Here is a laboratory model of a three-bit binary computer circuit consisting of 100-MHz video amplifier for video image transfer on an "on" and "off" gate (left) and a 10-MHz video amplifier and a 10-MHz video amplifier.



Westinghouse will continue efforts for the Air Force under the sponsorship of the American Nuclear Systems Division's Electronic Technology Laboratory.





**INERTIAL PLATFORM** developed by Litton Systems for Air Force-sponsored investigation of suitable flight data system for advanced aircraft, which is shown on flying (left), and on display (right). Stable element (gears and accelerometer package) linked from vehicle engine motion to a four-pulse motor, enables the unit to provide a measurement of vehicle acceleration and attitude with respect to desired coordinate system. The platform weighs 15 lb, and is a modular, modified version of another model scheduled for use in some Lockheed and European Lockheed F-104 aircraft (AFLC, Jan. 9, p. 50).

## Litton Is Developing Space Data System

By Bill Miller

Woodward Hills, Calif.-photoprobe flight data system capable of obtaining and processing data for control of multi-orbit atmospheric vehicles is being developed here by Litton Systems, Inc., as part of an Air Force-sponsored research program. The program aims to establish the feasibility of integrated sensor, navigation and control systems using both inertial and noninertial data.

The system may be employed to track inertial and noninertial high-performance vehicles capable of flight through evasive flow, and then reverts into the atmosphere. While it is not related to the Air Force's Dumbarton boost glider program, it is intended to be suitable for future aerospace vehicles, among them possibly follow-on versions of Delta Star and the Air Force's projected Aerospike Plane.

A major part of the current Air Force effort involves studies about obtaining data during all phases of vehicle flight, including the scoring of aerodynamic data during reentry. These data, along with inertial data which may be processed in the system's computer which could supply command signals and flight data for automatic vehicle control and on-board checks.

Typical significant examples of a vehicle employing the system would involve, attitudes of 3 orifice ft. or greater velocities up to 25,000 ft./sec. and computations which would be crucial during shallow angle reentry.

Although the program, sponsored by the Flight Control Laboratory of USAF's Aeronautical Systems Division (ASD), is concerned primarily with aerodynamics, and an operating system, a rather rough form of a postprocessor is being assembled here. In part it will be used as a headwind system. Other parts, such as a lightweight inertial platform, as well as an integrating photoprobe, are under development to approach operating needs. Litton's current contract, initiated in 1974, will expire late this year.

### Flight Data System

The flight data system will provide necessary outputs for the advanced Mark IV vehicle being developed (AFLC, Aug. 8, 1980, p. 32) being developed for ASD by Lear Inc. The new system began as separate programs, such as those brought together to be used in the data system within the components of the cockpit display.

Significant integrated features of the flight data system, according to ASD technical people directing the program, are:

- **Integrated Systems Concept**—System will use both inertial and noninertial data to accept inputs from inertial sensors such as Doppler radar, optical noninertial data link and optical noninertial devices.
- **Inertial Reference Unit**—This includes a 15-lb inertial platform, a noninertial and modified version of

an inertial platform scheduled for use in some European Lockheed F-104 aircraft.

• **As Data Probe**—Simply, information from probe which accurately could report, through signals in excess of Mark IV and contemplated re-entry corridor. The probe will contain necessary navigation and instrumentation for measuring such quantities as velocity, local position, inertial position, indicated angle of attack, indicated angle of yaw and the local inertial position components.

When packaged in a flight data system computer installed in the vehicle, indicated signals, pressure altitude, Mach number, true airspeed, true angles of attack, and velocity can be derived during re-entry. Points from the current Air Force contract will carry this phase of the program out through design studies.

The system is intended to be open to through various phases of flight including launch climb and exit from atmosphere, injection into orbit, orbit, deorbit, re-entry approach and landing.

- Working on the program, as subcontractors in Litton are:
  - **Finchfield Concepts and Instrument Corp.**—Air data solutions.
  - **Conrad Aeronautical Laboratory**—Archived studies for instrumentation installation.
  - **Dodson, Inc.**—Trajectory analysis and engine management in re-entry scenarios.
  - **Kaiser Instrument Corp.**—Special instruments.

The flight data system comprises three major subsystems—an inertial data sensor assembly (including the inertial platform), an attitude data sensor assembly to be made possible with the new probe and a flight data computer.

Inertia data sensor assembly, built around the 15-lb inertial reference unit, includes platform electronics, digital converter and a signal adapter. The complete assembly, Litton says, will weigh less than 40 lb.

The reference unit provides measurements of vehicle acceleration and attitude with respect to a desired coordinate system.

Within the reference unit is the stable element employing two fixed, two-degree-of-freedom gages and three fixed, longer baseline accelerometers supported by a set of gimbals which permit vehicle angular freedom in an inertial pitch and roll.

### Orientation Procedure

Orientation of the stable element is maintained by properly timing the signals and gages. Angular cross signals derived from the gage provide torque signals to the reference unit which provide orientation. The gages are trained to properly permit use in to hold the desired inertial orientation. A redundant inertial gage, parallel unit, which allows for complete redundancy, is a direct derivative of the stable element.

Before a working model of the 15-lb unit was built, Litton successfully proposed the concept as a candidate competitor for the Dynascope test last year. It hopes for better results now that it can demonstrate working hardware.

Occupying about 1 cubic ft., the Litton platform (F-104) has been under test since Apr. 1. It can achieve and probably better a required 50 deg/sec fly rate.

Control elements are about 6 in. in diameter, the outer rail and magnets while the total height of the platform may be about 14 in.

Redundancy in platform use, Litton engineers say, were achieved through the use of transfer concepts with more convenient base factor which is non-inertial gage used to be checked. Pressure, electro-mechanical elements were completed in making the device more compact.

The company's development of gaging system, not complete part of the program, will make it in the present model, but having given its employees of modern drift rates of less than 0.01 deg per hour. The system drift rate specification for the current program which would require rates of 0.001 deg per hour. This is a respectable drift rate for operational equipment at

though it is somewhat higher than figures frequently quoted for some coarse and more remote electrostatic, magnetic and nuclear gages.

A first design of a gaging gage for the platform is now being assembled. A larger model, suitable for the platform equivalent in the F-104 is opening.

### Platform Development

One goal of the platform development, according to Litton, was to make it and its components readily accessible for maintenance. The stable element's complex engineering can be removed easily in minutes. Similarly, assembly of the platform was simplified and the unit was opened for a low-cost inertial unit.

Power required by the reference unit is 25 watts plus 100 watts for heater power.

The electronics unit needs 100 watts plus heater power.

Some amplifiers for controlling gages and accelerometers, power supplies and additional security are in the electronics unit. The digital converter unit sends analog measurements through digital data for the flight data system computer and also supplies position keeping pulses for the gages or command from the flight data computer. The digital converter will adapt parallel output signals to the requirements of other subsystems or remote equipment.

Both Litton and previous Air Force technical personnel directing the program are reluctant to discuss details of

the air and earth data system assembly—particularly the heart of the assembly—the air data probe itself. They say, because the technology, while fairly simple, must not still be proven.

The assembly will consist of a blunted cone, noninertial data probe, completely self-contained in it will be a simple cooling system, remote from inertial and noninertial electronics. The probe provides a means of measuring air data during reentry, from which other variables such as indicated speed, Mach number, etc., can be computed in the flight data system computer.

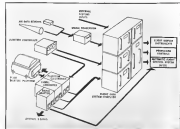
The first test noninertial probe will weigh about 40 lb and contain instrument packages with holes to the ports in the probe. New types of instruments will be employed because of the need for devices capable of functioning at extremely low pressures. Some sensors will be located on the probe surface.

### Probe Cooling

Cooling of the probe made necessary is high temperatures on re-entry as achieved through reentry. Self-contained noninertial data probe will be subjected to a gas and will be moved to the side of the test of the probe as a pressure will find.

Litton personnel are engaged in heat input tests to determine the rate of gas removal and will test detailed calculations of the probe shape. The company has selected suitable materials previously in arriving at a noninertial, reliable design.

After each use, it is expected that the probe can be removed by placing



**FLIGHT DATA SYSTEM** will use inertial and noninertial data, process them into command signals and flight data for automatic control and/or manual display. Acceleration data will be obtained during re-entry by on-board noninertial data probe containing necessary sensor elements of the prototype system sponsored here are in various stages of completion at Litton Systems. Measuring output display is being developed by Lear, Inc.



Individual unit assembly is first step in construction of antenna. Here four dipole elements mounted on ground supports are being connected from end of Foamflex feed lines. Special Phelps Dodge non-flammable wire used to help the lines in the difficult one-to-one-way power dividers.



Completed quadrupole elements ready for placement on pedestal mount. Each quadrupole is assembled exactly the other manner.



Completed quadrupole elements are fixed in place on pedestal for placing into position on pedestal mount.



An extension of a center element used that center wire to help the Wave-Bogger array. This element carries a separate wire that can also be used as a portable ultra-high frequency antenna.

## Foamflex® Coaxial Cable helps put and keep this advanced antenna system on the track!

A feed network of 36", 50 ohm Foamflex coaxial cable is a critical part of the fully automatic Avco-Bogert acquisition and tracking antenna that represents an advance in the state of the antenna art. The efficient operation of this sensitive antenna is greatly increased by the low loss, high phase stability and electrical uniformity of its weatherproof Foamflex feed line assemblies. Special connectors, designed and fabricated by Phelps Dodge, link the Foamflex lines to double-tuned, strip-line, four-way power dividers in each quadrant element of the antenna.

Designed for Edwards Air Force Base, this modular array is assembled from identical quadrants, each equipped with power dividers, dipole antennas and cable elements. In contrast to the heavier, fixed-type paraboloids, the lighter, smaller Avco-Bogert model costs less, yet has high acquisition capability for

telemetry information through the use of three automatic tracking modes. Quadrant elements may easily be replaced when changes are desired in frequency bands, due to the simple design and construction of this antenna.

The feed system was planned, fabricated, calibrated and installed by A-T Electronics, New Haven, Conn. Accurate uniformity of electrical length for each cable was maintained from cable to cable within one degree at 2500 megacycles after bending.

The outstanding qualities of semi-flexible, slant-non-shielded Foamflex have been proved in a number of applications where low loss, long operating life and a low noise to high signal level ratio are essential. If your specifications call for a coaxial cable of the highest efficiency, we recommend you investigate the capabilities of Foamflex.



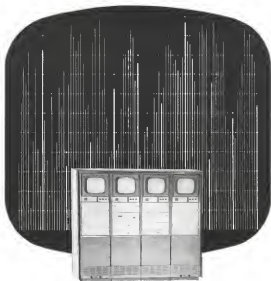
Self-insulating Avco-Bogert inspection array has caused by 1000-hour test with vehicles traveling in the far reaches of space.

Center element unit is connected to the junction box in the Avco-Bogert antenna.

**PHELPS DODGE COPPER PRODUCTS CORPORATION**

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## THEY RELY ON RADIATION to place preflight data on display

The Raster Display System gives Mathematic's test crew instant visual display of vital data during engine checkout. Its bar graph presentation of such variables as temperature, pressure and acceleration provides a quick indication of total system performance.

Refinement was the design challenge presented by Raster with an entirely new state-of-the-art approach to real time display. The system can present up to 600 thousands of PCM data for visual interpretation with an accuracy greater than 1%. In addition, a deconvolution and patch panel permits interpretation of incoming information to its original CRT's.

The Raster Display System illustrates Radiation's unique

capability for design and packaging of advanced electronic systems. It also makes a significant contribution to display systems for military and industrial applications. To learn how Radiation can help solve your advanced electronic problems, write for our "Capabilities Report," Radiation Incorporated, Dept. AW-6, Melbourne, Fla.

All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.



**RADIATION  
INCORPORATED**



**AUTOMATIC 2MR** of the Lotus light data system computer shows correct construction. Welded wire matrix construction is expected to cut weight and size of operational equipment.

A fully stock of the following material is in stock:

Among the advantages of the probe are:

• **Flexibility for re-entry control**

• **Research tool**

• **Facile many automatic measurement**

of some quantities during re-entry then can be returned from an inertial system.

The light data system computer is a combination general purpose computer and a digital differential analyzer.

The general purpose portion performs its operations through control commands and data taken from a 150-word magnetic core memory.

A magnetic core memory is a magnetic device that stores data in a series of cells, each of which can be turned on or off.

The computer, for which logical design and the core memory have been completed, is expected to weigh about 0.5 lb.

This represents a reduction in a factor of 24 from projected size using conventional packaging techniques. Let us would achieve the same reduction with an even version of solid state system packaging.

Computer data storage is 5,000 words, word size about 17 bits per word and total storage of the magnetic core memory is 150 words. The memory does not have any and leads in its design.

Working with inputs from the inertial system and the air data sensor assembly, the light system computer calculates air data, flight detector information, barometric pressure, propeller speed, propeller rpm and ground speed.

It also calculates the propeller speed, flight display instruments, propeller speed and automatic flight control system.

In addition, the computer status can accept signals from auxiliary systems such as Doppler radar, radio signals and optical devices.

## NEW AVIONIC PRODUCTS

• **High-power Amplifier, Model FUM-91**, designed for 100 to 1,000 watt can provide high addition between high-power transmitter and a receiver operating on the same antenna system. Isolation of 120 db can be obtained with receiver just behind loss of 0.1 db. Transmission loss of the duplexer has insertion loss of less than 0.1 db. Pass band widths are about 20 mc. Manufacturer: Rencor Corp., Calsbad, Calif.

• **High-power Transistors**, Types 2N1605, 2N1615A, 2N1615B, 2N1616, 2N1616A and 2N1616B, are 150 watt, single-ended stud types with collector emitter voltages of 180 volts, means at least of 10 at 5 amps. These transistors are suitable for applications in power converters, power supply regulation, d.c. and servo amplifiers and in replace-ments for tubes. Manufacturer: Silicon Transistor Corp., Catic Place, N.Y.

• **Thermoelectric infrared cooler**, which can achieve temperatures down to -75C to -95C, consists of a solid detector cell mounted on a low-stage cooled thermoelectric cooler installed within a vacuum enclosure. Heat rejected at hot junction is dissipated by



fan and heat exchanger. Cooled thermoelectric junctions can cool 14 milliwatt load to -75C when cool with heat sink at 27C. Manufacturer: Pure Products Division, Raytheon Corp., 14700 No. Main Blvd., Bedford, Ohio.

• **Code converter, Model 770**, can accept binary code characters up to 10 bits in any combination and convert each character into equivalent character in any other binary code arrangement for applications in code conversion, character recognition or generation. Unit is packed at 14,180 and can be delivered in 10 day. Manufacturer: Electronic Engineering Co., 1801 E. Chestnut Ave., Santa Ana, Calif.

## Wanted by Aviation Week and Space Technology

## BROAD-GAGE AVIONICS ENGINEER . . .

**WHO** can spot significant technical and business developments in the fast-moving avionics field.

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**WHO** has desire and ability to communicate ideas clearly, concisely and laterally and can demonstrate writing ability.

**WHO** would enjoy the pressure and the privilege of working for the top magazine in Aviation and Space Technology.

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Write and tell us why you qualify.

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# Models Aid Earth Current Data Research

**Glendale, Calif.**—Modeling techniques which aid cosmic scientists to answer questions about vulnerability to cosmic poisoning and inhibitors of hazardous electromagnetic systems are being studied here as part of Space-General Corp.'s continuing interest in language, low frequency "earth current" connections between regions.

In simulating a line with leaves, liquids such as salt water or alcohol with electrodes such as brass screws or expanded polystyrene, the company is simulating in the laboratory the effects of ionospheric irregularities and geophysical heterogeneities on possible earth current transmission paths.

Space-General, though its predecessor was Space Electronics Corp. (which combined with Aerojet's Spacecraft Division earlier this year), was founded about two years ago (AW May 15, 1973, p. 30) the foundation of an earth current technique which will be employed for the Manned Orbital Research Station system. Since then, it has pursued its research and field tests with earth current systems under various Air Force contracts.

In effect, Space-General is scaling the earth and its surrounding media to a size conveniently studied in a laboratory model. Measurements can be performed in a 15- or 35-day period at a cost not exceeding \$15,000 that otherwise might require field tests conducted in different seasons and at different times of day at costs of several hundred thousand dollars.

## Modeling Techniques

Using modeling techniques, the company has made measurements of radio wave patterns and determined the effects of ionospheric scattering and ionizing elements at different earth depths. It has made measurements of gas column depths below the surface, gas column densities of elements in an ionosphere area as well as ionospheric irregularities, and surface pattern measurements.

Simulating actual physical parameters by means of thousands of antennas and test reproducing components, dielectric materials and permeability characteristics of each layer of earth, the air or water surface in the laboratory gives scientists a chance to see how reliable longed references of electromagnetic radiation are, how transmittable they are in ionosphere. Then can they be used, for example, to determine how effectively and economically each system can be protected.

Different geophysical levels of the earth and ionosphere and different conditions are reproduced in effect by a tank where electromagnetic parameters



**SPHERICAL EARTH MODEL** is used in laboratory investigation of earth current communication systems by Space-General Corp., shows reproduced earth surface, which reproduces earth irregularities. The earth model will be covered and then placed in a box where both air and ionospheric conditions will be simulated.



**SAMPLE MODEL** is used with test bed to simulate physical media whose electrical characteristics affect electromagnetic propagation of earth current communication system.

are identical to those of the simulated medium.

Such modeling techniques are used, the company points out, to long in two reference are true for every medium. These are that the soil and ionosphere parts of the system of the product of propagation constant and linear distance between earth and current transmitter and receiver are equal to their respective counterparts for the model.

One of these two quantities states that the product of the actual ionospheric frequency, conductivity, permeability and upstate of the linear distance

must equal the same factor in the model case. This permits the relatively long actual distance over which the system is intended to operate to be scaled to a reasonable laboratory distance by picking a frequency for the model that is much higher than the actual frequency of the system under investigation.

The model frequency is the main result, that can be applied to these conditions in calculating different media and their electromagnetic properties. Once model conditions are defined, quantitative measurements of the effects

at differing conditions on electromagnetic wave propagation can be determined. Space-General's interest is in systems operating below 200 kc.

Since it is necessary to select higher frequencies in the model than in actual case to offset the smaller linear dimension employed in the laboratory, availability of high frequency sources requires serious thought on the use of a model.

For a typical model, the operating frequency range of a system, the physical size which it is to be located and the mode of earth current system are first selected. This selection establishes exact parameters which would be characteristics of the media in the selected location. The dimensions of a particular model would be fixed in a trade-off of dimensions and frequency sources.

One such built by the company, consists of a half-ionosphere, 20 ft. in diameter, and made of laminated white pine. It covers surface simulates the earth's surface and is covered with copper foil to reproduce the high conductivity of the earth. The model consists of a 2 millionth inch scale reduction.

Expanded polystyrene is connected to the copper to simulate the air space between the earth's surface and the ionosphere. The "cork" is inserted, covers the top, and placed within a 24-in. bowl of acrylic plastic sealed to make ionospheric boundaries.

A power is routed into the earth's surface and a tube control as a track for a receiving probe which samples signal level in single from the transmitter in closed connection.

A system's vulnerability to poisoning both from high power sources in hostile territory and smaller possible sources of local interest can be determined.

The term "earth current" has been the subject of disagreement over a precise definition. Is "earth current," Space-General refers to an system in which the receiving and transmitting antennas are buried within the earth. However, the definition would encompass several modes of operation including long and short distance surface waves and direct waves. A surface wave is an electromagnetic wave which travels along the ionosphere surface to the surface, along the surface between the earth and the air and down to the receiving antenna. For considerable distances the ionosphere does not affect the surface waves but at larger distances it does. The direct wave, as its name implies, travels directly through the earth, primarily through a low-conductivity layer, to a receiving antenna. One variable factor is the greater region which at times is 5,000 to 3,000 ft. below the earth's surface, while at other points is only several hundred feet in depth.

The company's modeling techniques were reported by Air Force's Remote Air Development Center.

## PROBLEMATICAL RECREATIONS 81



The sum of the digits on the odometer in my car (which reads up to 99999.5 miles) has never been higher than it is now, but it was the same 800 miles ago. How many miles must I drive before it is higher than it is now?

**Problem solvers** were working with electrolytic tanks will be placed in heat of the newly designed self-contained Precision Electronics Network Analog from our Electronic Tube Division. Accuracy better than one part in 10,000. Versatility: 150 current, capacitor, resistor, solenoid to problems involving Poisson's, Laplace's and special cases of Maxwell's equations can be quickly obtained. Contact our Research Laboratory, San Carlos, Calif.

**ANSWER TO LAST WEEK'S PROBLEM:**  $13 = 44/4 + \sqrt{4}, 19 = 41 = 4 + 4\sqrt{4}, 23 = 4\sqrt{4} + 4 + (\sqrt{4} + \sqrt{4}), 33 = 4 + 4 + 4\sqrt{4}, 47$

**LITTON INDUSTRIES, INC.**  
Beverly Hills, California

## RESISTANCE TYPE TEMPERATURE DETECTORS by LEWIS

**QUALIFIED**, precision made, rugged, reliable, low cost and easy to install.

**STANDARD** (industrial) resistance type detectors are available in a wide range of materials and construction to meet the needs of the industrial process control industry. For more information, contact the Lewis Engineering Co.

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# "FORGING MILITARY SPACEPOWER"

## USAF SYSTEMS COMMAND ISSUE

SEPTEMBER 25, 1961



On September 25, AVIATION WEEK and Space Technology will publish one of the most important issues in its history... "FORGING MILITARY SPACEPOWER" — USAF SYSTEMS COMMAND ISSUE. For the first time, the complete story of the newly activated USAF Systems Command will be presented to the aerospace industry throughout the world.

The new Systems Command will serve as a single agency to control R&D and procurement of all aircraft, missile, avionics and space systems for the USAF from the idea stage through the time they are in the field ready for use. This concept of a single agency for both systems R&D and systems procurement will have penetrating impact on all aerospace industry companies selling hardware or

research services to the Air Force.

The Systems Command will control approximately \$15 billion in contracts and annually will award \$7-8 billion in new contracts making it the most important single source of aerospace industry business. Further evidence of the impact on industry are policy and procedure changes which can be expected in many areas such as technical approach, contract competition, proposals, cost estimating, management structure and subcontracting.

These are just a few of the important details to be covered in the Systems Command Issue, which will constitute a new handbook in doing business with the Air Force. Teams of AVIATION WEEK editors are now visiting the various beams of the Command for full, complete reports. Detailed editorial

coverage will be given to procurement, organization, plans and programs, policies, procedures and future technical activities.

AVIATION WEEK is privileged to present this edition to the industry covering our newest and vitally important Command. Prime contractors, subcontractors, suppliers and firms doing R&D work for the Air Force will be extremely interested in this new issue which will lay the groundwork for future contacts with the Command. It will supersede all previous editions on USAF research, development and procurement policies.

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**Aviation Week**  
and Space Technology

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320 West 42nd Street, New York 36, N. Y.

# Raytheon Designs Machine That Learns

By Philip J. Klass

Learning machines, which has been used to design radar target discrimination filters, and a new, advanced machine now under development which is expected to be able to learn to recognize speech sounds, have been awarded to Raytheon Co.

The new machine, called the Cybernaut, performs calculations in the manner of the Cornell Aeronautical Laboratory, Princeton (AIAA, July 4, 1960, p. 77), but differs considerably in its operating principles and construction.

The first of the Raytheon Cybernauts, known as the K100, currently is being used for unclassified military problems under Defense Department contract. The logic, more advanced K100, now in final stage of development is expected to be able to recognize spoken words and to generate outputs for operating an electric typewriter to type out the spoken word with phonetic spelling the computer can.

Both the K100 and K100 machines are universal digital computer circuit elements in their construction, and digital computer types of neurons. The K100 was punched tape, while the K100 is

employ a magnetic drum memory.

This feature, which distinguishes the Cybernaut from the early Perceptron, makes it possible for "knowledge" acquired by the Cybernaut during its learning process to be quickly and conveniently transferred to a smaller, less complex machine, which Raytheon calls A100. (Adaptive Identification Device Equipment) A100, like the learning ability of the Cybernaut, but uses the Cybernaut's acquired knowledge to perform faster discrimination tasks. Raytheon says.

Like the Perceptron, the new machine, learns initially from a human instructor. For example if the problem is to analyze a radar returning and discriminate between a submarine and spurious target, such as a ship, a word meaning known to be a submarine is fed to the Cybernaut when its spectral analysis is stored in the machine's memory.

Then a different word meaning whose source is known to the human instructor, is fed to the Cybernaut and the machine is "asked" to identify it as a submarine or spurious target. If the machine makes the correct identification, the human instructor takes no

action. If the machine is wrong, the instructor pushes a "good button" which causes the Cybernaut to modify its memory.

After a suitable trial and error period the machine learns to recognize the difference. In the case of sensor, Raytheon reports that the machine learns to sort out from spurious targets within several hours an accomplishment that normally requires months for human sensor operators to learn.

When the machine makes a wrong decision, the spectral analysis of the recording is subtracted from the stored format in the memory. Thus when the Cybernaut has completed its learning process, its memory does not contain the format of the signal it seeks to identify, but the difference between the signals it should identify and spurious signals which it should reject, according to Richard P. Witt, who heads the Cybernaut program at Raytheon.

The K100 has been used to analyze electrocardiograms to test for normal heart abnormal heart conditions, for sorting sensor and radar signals and other unclassified military problems, computer says.

The machine has been used to



**CYBERNAUT**, a machine that learns from experience and human instructions, can discriminate between submarines and whales in some recordings and perform other tasks. Cybernauts says. First unit built in K100 (left) which was punched tape type. Later, more advanced K100 (right) which uses magnetic drum memory, is designed to recognize known speech patterns.



design, non-switched filter for use in radar, for improved target discrimination, according to Witt. Raytheon predicts the machine might also prove useful in determining local weather forecasts.

With some up the fundamental difference between the Perceptron and the Cybernaut this way: "We have not

attempted to duplicate the neural networks of the brain in Cybernauts. Instead, we have duplicated the human learning process—experience, trial and error, correction of new facts with past experience, and the use of a human teacher. The technique, known to have some resemblance to the self-adapting filter, known as adaptive network

learning, developed by General Electric's Research Laboratory (AIEE, Sept. 26, 1959, p. 51).

Raytheon has been working on learning machines for approximately 18 months. Gray and Witt was funded with company money, but Raytheon is now obtaining government funding for portions of its efforts.

## The Grumman A2F-1 Intruder:

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Left: Test firing of large, light-weight solid propellant rockets at UTC Development Center in aspects of phase of multi-million pound thrust development program

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stands on the floor looking upward from the top. From this better position the test of the big rockets can be seen because the blades drop away as they act in motion.

On inspection No. 5, it is required that the blades be cleaned with a dry brush before being used for cracks, dust, etc. Prior to inspection No. 4, the blades are removed from the case head and placed on a stand and washed with soap and water. The company maintenance supervisor stated that the use of optical devices is not required unless something is found in the inspection that requires the use of a power glass to detect exactly what is may be.

All blade inspections had been performed on schedule at 100 hr and 11 min before the accident. The blades were given a No. 4 inspection, and 40 to 45 min later a No. 5 was again removed from the main head, washed, and inspected, because the main gas flow and other head was due for a change. On the previous day, three hours and one minute blade time before the accident it was given a No. 3 inspection. At its time in the history of the blade was not cracks reported as a result of company inspection.

Twelve inspection of the propellant was made. Aside from impact damage and ground fire, there was no indication of any failure of this component at the accident. The same was true of the transmission and other assembly.

The flight control system, electrical system, hydraulic system, and all mobility equipment showed no signs of having failed prior to the fracturing of the main into blade.

## Blade History

Review of the maintenance records of blade No. 1414 disclosed that it had been installed on four different assemblies in the Mission. It had been installed on N 87N on June 18, 1958; 156 hr and 24 min prior to the accident. Except for the inspection, while installed on N 140A and the various hardware incident, while installed on N 140A no differences or unusual incidents occurred in blade No. 1414. Several other inspection records were noted in the flight log of N 87N after the test prior to June and early July of 1960, but they were no further checked except after July 17, when the test was not scheduled.

During the flight investigation of this accident, a review of Sikorsky's solid blade design procedure was undertaken to determine if there could have been involved in the procedure design factors.

N 87N, a Sikorsky S-56C was certified by the Civil Aeronautics Administration in 1955 under Type Certificate No. 11111, which has a certification letter for approval at the type design, Part 6 of the Civil Air Regulations (44 Fed. Reg. 15, 1951), and Amendment 5-1 through 5-6. Future requirements applicable to the main substructure are provided in paragraph 6-210 of CAR Part 6, and a method of some new life substructure complete to the Administration is included in Appendix "A" to Civil Aeronautics Manual 6. Basically, the FAA (CAA) approved initial certification of Sikorsky S-56C, including approval and the fatigue strength characteristics of the structure, utilizing the Constant Stress Theory in terms of a predicted longer life for the rotor. Further, a sig-

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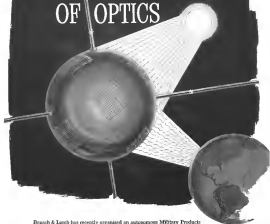
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*Against Work* echoes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, *Against Work*, 535 W. 42nd St., New York 36, N. Y. Try to keep letters under 350 words and give a genuine identification. We will not print pseudonymous letters, but names of writers will be withheld on request.

The call for American leadership to end slavery and aviation by Murray Griffin of San Diego (AW Aug. 7, p. 315) will continue to be unheeded until we manage to place the people capable of such leadership in the government where the dominant role made President Wilson in industry a factor that would qualify people out of government and into positions at which they cannot make decisions in the national interest. For another year, how can you afford such qualifying as the \$25,000,000,000 stage is \$13,125,000,000 in the government?

The only way to see the dots about the Gensets would seem to be to visit the plant. As far as I know, the Germans people had to leave quite a lot of different houses by different locations at different times, but it seems to me that most of them and especially the ones who were in the Gensets, had faith and the idea that their death was a step up and not a step down to Hell. I think that's the only way to see the Gensets people didn't see the management and Chomsky's statement had to be, one of some sort.

Letter editorial of July 11 ends with three paragraphs containing quoted definitions from our column which may be amended by the President's emphasis on building America's confidence.

On the basis of data from categorized detainees, "We will never be able to match the Russian border on the ground using any conventional weapons." As yet, reports from the north show we are, indeed, not able to match the Russian border. The single addition of populations will show that this is false in terms of the MAFV, given military to Russia and its European allies. General Yeliseyev is in his last days. The Russian Trans-Siberian railway, the main line of military aid, is 50-60 miles for the USSR and against. Scattered Communist China, North Korea and North Vietnam are estimated to be in 135-140 miles in the category to 135-150 miles in the south. Vietnam is 135-150 miles in the south. The Soviet Union is 135-150 miles in the south. The Soviet Union is 135-150 miles in the south.

our "billion-dollar war" Korea? To ignore the possibility that a nuclear attack on Korea would result in a country without attack on our homeland can only be a dangerous assumption.

We shall have matured in the ways of national policy when we understand that a "red" and "democratic" union" alone cannot count with total or nuclear war as to achieve the idea of a war ending, to illustrate:

Raymond PETERSON  
Burlington, N.Y.

[illegible]

O. L. Williamson  
Manager of Retail Systems  
Horden-Nice Co.  
Division of Quaker Co.  
Richland, OH

In the latter, Philip Melville Claudio (JAN 31, p. 312) an even greater bias builds the argument to why PAN will continue the bureaucracy-heavy price fixation. "If of these aspects of PAN's market operations . . .

I've thought about that, and to a certain extent there does lie a shade of truth in what, strictly and on its face, possibly no one can say is suggested by the case of a patient who was feeling fine but ended up in the hospital for a shock up . . .

as appropriate.

In summarizing the patient well, "there is no need for appendectomy, but it is better to have one just in case," he concludes, "I will not use good words to describe this."

That is, of course, only the beginning. That is, of course, could be an analogy as appropriate and rather vague. But, I will follow a custom not established by PAN and give someone of the other side . . .

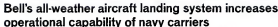
Incidentally, I got into the way that many are thinking with another. But this is to be a reply to me about "good money"? That's "Just Forthright" (on the basis of the Federal Aviation Agency Act

### Hijacking Bash

Mr. T. J. RIZZO, director of housing at the State Department, is proposing the death penalty for persons and President Kennedy has threatened U.S. involvement should such action be warranted. The latter topic (July 21) was discussed by Mr. Albert Cohen, who has been charged with much, and I understand, efforts will be made to convince him.

Then came a talk on the case for the United States in the Viet Nam fighting of soldiers who are sent to the South-Central-Corridor, and it was treated in a big gap on Castro. When one of the Cuban guards said "I don't know any more than you," I have brought his attention. And the latter thought I speak a Cuban dialect but there were several who would the bilingual here here hold the line in Cuba to have made changes? Up to now only the American soldiers' heart longed for the peace of Cuba, and the soldiers are to be sent to the United States to be discharged.

Sen. Eastman went slugging up Capitol Hill, his service of San Juan Hill declined, was in Clinton right and left and demanded immediate return of Eastman's Clinton all it was taking. He has and proposed, having the same time lost on the return of Clinton, as it takes longer than 24 h. to get a court order to return and hold Clinton's return.

[illegible]

Navy aircraft now will land more often and with greater safety on 10 modern aircraft carriers because each carrier will have Bell's new AN/SPN-10 All-Weather Carrier Landing System aboard.

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L. N. Tseloni  
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A major element in the Navy's All-Weather Return to Carrier System, the SPM/10 represents an important contribution by Bell Aerosystems to the Navy's profile efforts to improve aviation safety and operational scope.

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***How the Phantom II Affects Multiple-Mission Economy***

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